Supreme Court of the United States

OCTOBER TERM, 1923.

No. 159.

ELECTRIC BOAT COMPANY,

Appellant,

vs.

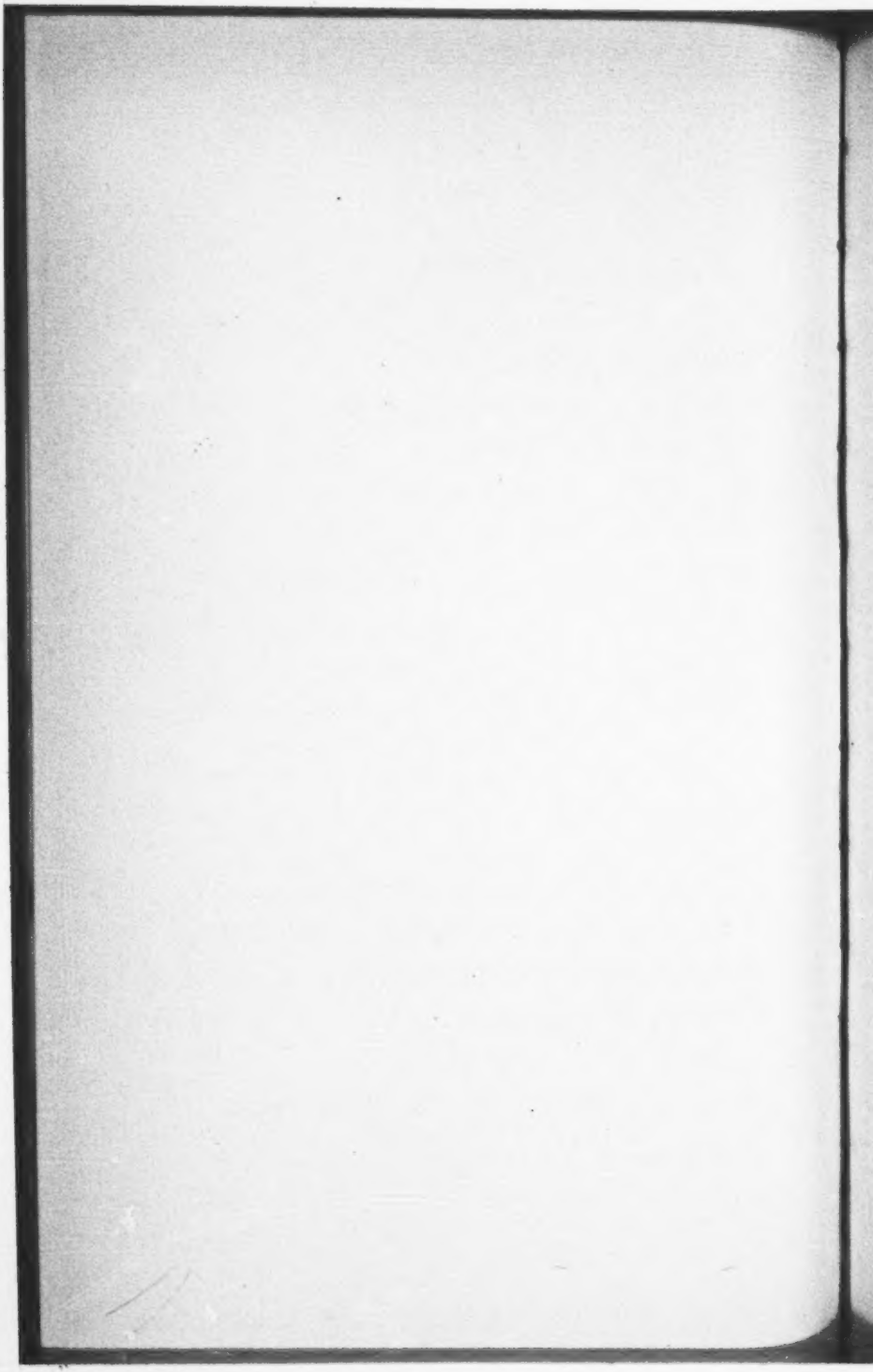
THE UNITED STATES.

APPEAL FROM THE COURT OF CLAIMS.

BRIEF FOR APPELLANT.

FREDERICK P. FISH,
WILLIAM H. DAVIS,
DEAN S. EDMONDS,
Counsel for Appellant.

PRESS OF PREMIOTT PATTIE, INC., 30 Washington St., New York City.



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ELECTRIC BOAT COMPANY vs. THE UNITED STATES.	October Term, 1923. No. 159.

BRIEF FOR APPELLANT.

This appeal is from a judgment of the Court of Claims in a suit brought by Electric Boat Company to secure payment of royalty due under a license agreement dated April 2, 1912. The license provides for the payment of a fixed royalty to the Electric Boat Company for the use of certain patented inventions in torpedoes constructed for the United States "either in its own shops or by contract in private shops." Four patents are covered by the license but only one of them is directly involved in this suit.

Statement of the Case.

The patented inventions relate to steam generators for self-propelled or automobile torpedoes, that is, to the power plant by which the torpedo is propelled through the water on its errand of destruction. Prior to the inventions, the torpedo art had passed through certain stages of evolution to the point of producing a self-propelled torpedo which would travel through the water a distance of about

4,000 yards. But that range was distinctly deficient, because large Naval guns were accurate at two or three times that distance. For years the torpedo art sought the solution of this problem of range, but it remained unsolved until the present-day, long-range, 10,000 yard torpedo was produced by using the invention described and claimed in one of the patents covered by the license. That patent is No. 1,036,080 (Rec., pp. 25-31) granted to appellant as assignee of Gregory C. Davison on August 20, 1912, on an application filed by Mr. Davison on March 29, 1909.

The Davison patent discloses a special form of power plant for supplying motive fluid to the engine of a torpedo; that power plant is known as a steam generator because the motive fluid supplied by it consists largely of steam. A fuel, such as oil or alcohol, is burned at a high temperature in air or oxygen, and water is injected into the highly-heated products of this combustion to increase the volume of the motive fluid by vaporizing the water to form steam, and also to reduce the temperature of the hot products of combustion so that they may be introduced into the engine without danger of injury thereto.

In the power plants of the torpedoes in use at the time of Davison's work, fuel and air were burned and the hot products of this combustion formed the motive fluid; but such plants produced an insufficient amount of power, for the quantity of fuel that could be burned was limited by the temperature of the motive fluid which the engine would stand without injury. Such torpedoes were used to a considerable extent but their deficiencies were fully appreciated and they left the range problem an active issue confronting naval engineers.

Furthermore, prior to Davison's invention, suggestions had been made that water be introduced into the hot products of combustion to cool them and to generate steam; but none of these suggestions had materialized in a practical device with which relatively long range was actually obtained. The first torpedo mechanism practically adapted for the use of water to generate steam and drive a torpedo over a substantially increased range was that devised by Mr. Davison and disclosed in his patent.

The operation of such a steam generator requires the presence of air to maintain the combustion, of fuel to burn, and of water to be converted into steam. These three elements must be forced under pressure into the combustion chamber. The distinguishing and characteristic feature of Davison's invention which changed failure into success and disposed of the range problem for all time, is the idea of generating greatly increased power by admitting water to the hot products of combustion of air and fuel and automatically controlling the supply of fuel and water by the application thereto of the air pressure under which the air is fed into the generator, thus insuring that these three elements of the motive fluid will, under all circumstances, flow into the generator in correct relative proportions previously determined upon. This solution of the problem doubled the range of automobile torpedoes and brought them again to a parity of range with Naval guns.

Davison had been an officer of the United States Navy, and while he was engaged upon the development of the long range torpedo, he kept in touch with his former associates of the Navy and they were constantly informed of the progress of his work. The Navy Department itself undertook de-

velopment work upon a steam generator torpedo for increased range at the Naval Torpedo Station at Newport, Rhode Island; this experimentation extended over a period of many months but it failed to produce a successful form of steam generator and therefore the use of the water injection was abandoned.

Immediately thereafter, the Navy Department, through its torpedo officer, urged Mr. Davison to continue with his work on the development of the long-range steam-generator torpedo. Later a torpedo of the old type belonging to the United States Navy was delivered to appellant and was equipped with a steam generator under Mr. Davison's direction, and the complete success of the invention was demonstrated by a run of this torpedo of over 6,000 yards, that is, an increase of range of over 50% as a direct result of the application of the steam generator.

For many years the Navy Department had been having its torpedoes made by E. W. Bliss Company of Brooklyn and that Company's facilities for such manufacture were extensive. Some years after Davison's application for patent had been filed and after the experimental work at the Naval torpedo station above referred to, the Navy Department contracted with the Bliss Company for the manufacture of one experimental torpedo specially designed to develop long range. That torpedo was completed in the fall of 1911; it was equipped with a steam generator embodying the principles worked out by Davison and covered by his pending application for the patent here in issue, and when it was subjected to test, it ran over a range of 10,000 yards. Thereupon, negotiations were opened between the Navy Department and this appellant for a license to the Department under the

patents to be issued to Davison on his applications then pending. The proposed license was the subject of discussion and correspondence in Naval circles, the more so because the officer in charge of the Newport Torpedo Station was opposed to entering into such a license and pointed out in substance that if the license were executed the Government would be forced to pay royalties on torpedoes of the type which the Bliss Company had made. The Naval officials at Washington replied to this objection that the Davison inventions were patented and proceeded with the negotiation of the license agreement. Such suggestions as appellant made with respect to the agreement were promptly adopted; in particular, the Navy Department stated in a letter to appellant that the license covered by the agreement to be prepared would cover all of the old superheater torpedoes which would be converted to steam generator torpedoes, but appellant immediately replied that it understood the license would apply "also to torpedoes which the Government may build at its own works and in which the device in question is to be used." Immediately thereafter, the agreement was drawn up by the Department and so worded as to cover all torpedoes embodying the inventions described and claimed in the patents to be issued on the Davison applications. The Navy Department officials had quite definitely in mind that the license covered the long range torpedo of the Bliss Company and immediately on concluding the negotiation of the license, an order for a supply of those torpedoes was awarded to the Bliss Company.

It is with respect to those torpedoes supplied by the Bliss Company on that order and other similar ones supplied on subsequent orders that this appli-

cant seeks to recover the agreed royalty provided for in the license.

In the Court of Claims no question was raised as to the validity of the Davison patent or the existence of the license agreement; and the construction of the Bliss torpedoes was established by drawings provided by the defendant.

After argument at final hearing upon this testimony, the Court of Claims filed tentative findings of fact sustaining plaintiff's claim and set the case down for further argument on those tentative findings. After this second argument, the tentative findings, changed in some small respects but not in substance, were adopted as definite and the Court recorded its "conclusion of law" that "the plaintiff is entitled to recover." At the same time, the Court filed an opinion in which the plaintiff's position is stated and upheld with a clarity and force with which the Court's subsequent contrary decision makes a strange contrast. This first opinion is printed as an appendix hereto (*post*, p. 99).

Thereafter a motion to reopen for further testimony was submitted by the defendant, and after argument thereof, the Court withdrew its opinion, its findings of fact and its conclusion of law, and filed an order permitting defendant to take further testimony. Further testimony was taken and the case came again before the Court for argument. At this argument, defendant took the position that the license, which by its terms includes "torpedoes equipped with steam generator for automobile torpedoes covered by" the patent and patent applications listed in the license, should be limited to a specific construction of steam generator shown in a drawing sent by plaintiff to the Navy Department in connection with certain work which plaintiff

was doing for the Department under another contract.

Following this argument, the Court filed another set of findings of fact quite different from those originally filed, a "conclusion of law" that "the plaintiff is not entitled to recover" and a *per curiam* opinion of 21 lines (Rec., p. 23).

This final opinion of the Court of Claims is such that it is difficult to state the reasons for the Court's conclusion that "the plaintiff is not entitled to recover." It is clear that the Court did *not* decide against plaintiff on the one and only ground urged by counsel for defendant at the last argument before the Court of Claims, namely, limitation of the license to the construction shown in a particular drawing. No mention was made of this contention of the defendant in the opinion and the drawing which was said by defendant to illustrate the construction to which defendant argued the contract was limited was not made a part of, and was not referred to in, the Findings of Fact.

We judge that the Court concluded that certain differences which exist between the torpedo manufactured for and used by defendant and the torpedo illustrated and described in the patent in suit are of sufficient consequence to justify a conclusion that defendant's construction does not fall within the scope of the patent, for the Court said in the opinion (Rec., p. 23) that "the question resolves itself into whether the Government used the plaintiff's device or something covered by one of the claims of its patents." We maintain that the Court erred in its conclusion that "the plaintiff is not entitled to recover" and ask the judgment of this Court thereon.

As stated above, no question is presented as to the execution of the license agreement, or the

grant of the patent relied upon, or the manufacture and use of the torpedoes on which royalty is claimed, or the specific construction and operation of those torpedoes. A single question is presented, namely, whether or not the torpedoes so constructed are within the patent and therefore within the license and subject to the royalty payment provided for therein.

That there are some differences of minor consequence between appellee's torpedo and that of appellant's patent, is not denied. We maintain that those differences are due to refinements developed by the patentee to secure further desirable results which in practical operation appellee has preferred to dispense with in order to secure greater simplicity; but that the omission of these refinements does not differentiate appellee's construction or method of operation from the patented one, or establish that the inventive idea originated by the patentee is not utilized. On the contrary, we maintain that appellee's construction and the patented construction are essentially the same, that appellee's construction is a full and complete embodiment of the idea of means disclosed in the patent, that the patent claims are as applicable to appellee's construction as they are to that illustrated in the patent, and that the specific object of the patentee in making the patented invention, namely, increasing the range of automobile torpedoes, is attained with appellee's construction to the remarkable extent of more than doubling the range of that type which immediately preceded the one on which the royalty is claimed. This remarkable result is attained by appellee *solely because of its use of the precise invention disclosed in appellant's patent and clearly defined in the claims of the patent relied on in this suit as the invention sought to be protected.*

Evolution of the Automobile Torpedo.

The apparatus involved in this suit is usually designated as a Steam Generator for Automobile Torpedoes. It is the power plant which is installed in a torpedo to supply motive fluid to the engine which drives the propellers of the torpedo. The engine may be either a reciprocating engine or a turbine, and in either case it is connected to two propellers at the stern of the torpedo, rotating in opposite directions about the same axis, to propel the torpedo through the water. Such a torpedo is commonly provided with two rudders, one vertical and the other horizontal; the vertical rudder is operated automatically by a gyroscope to steer the torpedo on a straight course, and the horizontal rudder is operated by automatic mechanism controlled by the pressure of the surrounding water to maintain the torpedo at a predetermined depth below the surface of the water throughout its run.

The self-propelled or automobile torpedo dates from about 1878. In nearly all forms that have gone into practical use, the propelling medium has been compressed air. The construction employed has always included a cigar-shaped shell divided by interior partitions to form a chamber at the bow for the explosive, next back of this a chamber for the storage of compressed air, and back of this a chamber for the propelling engine and the mechanism associated therewith, the engine being connected to two concentric shafts extending back through the aft end of the shell and carrying the propellers.

The air stored in the compressed air chamber may be compressed to as high a pressure as 2250 pounds per square inch. In the pipe leading from

the chamber back to the engine, a reducing valve is installed for reducing the air pressure to about 300 pounds so that air is admitted to the engine at a uniform pressure of 300 pounds throughout the run of the torpedo, although throughout that time the pressure in the storage chamber would be falling steadily from the initial pressure of 2250 pounds down to a final pressure of about 300 pounds. Torpedoes of this simple form were used extensively up to about fifteen years ago but their range, that is, the distance such a torpedo would be propelled by the charge of compressed air it is capable of carrying, is exceedingly small when measured by the standard of present-day practice. (Rec., p. 9, Finding IV).

As improvements were made year after year in naval guns, increasing the range at which they were effective, it became essential to increase the range of torpedoes to make them serviceable. In fact, the entire history of the automobile torpedo art is a record of effort to extend the range (Rec., p. 10, Finding V).

About 1901, a step toward this very desirable end was taken by heating the air in the compressed air storage chamber to give it greater expansive power, and this practice soon crystallized in the use of what has since become known as the "inside superheater." This consists of a burner *located inside the compressed air storage reservoir* and supplied with alcohol or other hydro-carbon, which is ignited as the torpodo is launched and burns throughout the run to heat the air within the storage chamber and thus hold its pressure more nearly up to the original storage pressure while air is being drawn from the chamber during the run. This inside superheater proved to be dangerous and far from satisfactory, but it was used

to a considerable extent and it did increase the range materially. Its use covered the period up to about 1908 and the range attained with it ran as high as 3000 yards. (Rec., p. 9, Finding IV.)

With further improvements in naval gunnery, a further increase in the range of torpedoes became highly desirable, and when the deficiencies and limitations of the inside superheater were fully realized, it gave way to what has become known as the "outside superheater." This consists of a chamber or enlargement in the air pipe carrying air from the storage reservoir to the engine, and devices for admitting liquid fuel, such as alcohol or gasoline, to this chamber at a uniform rate throughout the run of the torpedo; the fuel is sprayed into the chamber and mixed with the air therein, forming a combustible mixture which is ignited at the beginning of the run of the torpedo. Thus, throughout the run, combustion takes place in the chamber and the air passing therethrough to the engine is heated and its expansive force increased prior to its admission to the engine.

The outside superheater was a great improvement over the prior inside superheater and this led to its adoption by the United States Navy in 1909. It was much more safe and much more reliable, and with it an increase of range was attained. The range of torpedoes so equipped was about 4000 yards (Rec., p. 9, Finding IV).

But that range was far below what was desired and it could not be extended. The possibilities of the outside superheater were limited by the requirement that the air passing through the superheater on its way to the propelling engine must not be heated above a certain predetermined tem-

perature, since otherwise it would injure the mechanism of the engine.

This limiting temperature was such that only a small fraction of the oxygen in the stored air was used for combination with the fuel to form the combustible mixture which was burned in the superheater. All of the rest of the oxygen in this air was available for combustion, but it could not be utilized for that purpose because then the temperature would be so high as to melt the metal of the engine.

As stated above, the range attained with the outside superheater was insufficient; naval guns of that day were accurate at distances of two or more times 4000 yards. This condition was so serious that naval tacticians of 1908 and 1909 considered the automobile torpedo a very inferior weapon, of very limited utility. Battleships were equipped with such torpedoes, but they were thought to be of secondary value, useful only in event of encounters between fleets which would bring vessels of opposing sides in close proximity. On torpedo-boats or destroyers, torpedoes were to be used only in a night attack or in a fog, for in daylight a torpedo-boat would easily be destroyed by the guns of a hostile ship before it could approach to a point at which a torpedo could be launched with any hope of having it reach its mark.

This was the condition of the automobile torpedo art at the time when Gregory C. Davison made the invention covered by Patent 1,036,080, under which the appellee is licensed.

The Davison Invention.

Mr. Davison's intensive study of the subject led him not only to a clear appreciation of the above-mentioned limitations of the outside superheater, but also to a full realization of the fact that the energy available to propel a torpedo could be enormously increased by developing as much heat as possible in the combustion of *all* the oxygen in the air and a relatively large quantity of fuel, and introducing into the intensely hot products of combustion a sufficient quantity of water to be converted into steam, thereby absorbing heat from and thus cooling the gases of combustion and producing a large volume of steam.

He proposed to change the combustion chamber of the outside superheater in which only a small fraction of the oxygen entered into combustion with the fuel, into a steam generator in which all or substantially all of the oxygen of the air, or even the increased oxygen supply of an enriched oxygen-carrier, was made use of to produce the new motive fluid. He considered the compressed air not merely in its dynamic sense as a motive fluid, but also in its chemical sense as a carrier of oxygen and he referred to it as an "oxygen-carrier" throughout his patent. This state of mind may be looked upon as the cultural medium in which the invention was developed.

Davison proposed that *all of the oxygen in the compressed air* be utilized in combination with the fuel, thereby making it possible to burn a far greater amount of fuel and thus develop a far greater amount of heat; and *this heat he proposed to utilize in vaporizing water,* thereby producing a motive fluid consisting of a mixture of steam and

the hot gases of combustion, which fluid would have great volume because of the steam contained in it and would be at a temperature suitable for admission to the engine because the great heat developed by the combustion, which would otherwise destroy the metal parts of the engine, would be absorbed in vaporizing the water.

As in the case of other inventions, it was necessary for Davison to couple with this idea of purpose or end to be achieved, a practical idea of means so well adapted to the peculiar conditions under which the steam generator was to operate in an automobile torpedo as to result in a completed operative device suitable for practical use and actually available in tangible form to produce the desired increase in range.

Davison's first attempt was an abortive one; it is represented in his patent No. 1,036,082, for which he made application on March 19, 1908 (Ex. C-15, Rec., pp. 135-144). At first he did not appreciate the possibility and advantage of injecting the water directly into the combustion chamber, nor had he conceived the idea of establishing and maintaining a correctly regulated flow of fuel and water by *utilizing the pressure of the air and hence its rate of flow into the generator chamber as a regulator* to govern the rate of flow of the fuel and water into that chamber.

Subsequently, in the summer and fall of 1908, Mr. Davison proceeded with the development work and produced the arrangement of his patent No. 1,036,080, here in suit.

In this arrangement, as in the preceding one, Davison provided for the admission of water and fuel to the generator chamber; but there was this distinguishing difference, that an *automatic regula-*

tion was provided for the rate of flow of the air, fuel and water into the generator chamber whereby these three ingredients would enter the chamber always in the proper proportions. Any variation in the rate of flow of the air from the supply chamber to the generator chamber would be accompanied by an immediate and corresponding variation in the rate of flow of the water and fuel. Thus there could be no excess of fuel or deficiency of water, either of which would result in the production of motive fluid at such a high temperature as would melt the metal of the engine, and there could be no excess of water or deficiency of fuel, either of which would cause a great loss of efficiency. All three ingredients used in the generator chamber to form the motive fluid entered into the chamber always in the proper proportions and always under automatic and immediate control obtained by making the rate of flow of the fuel and water dependent upon the rate of flow of the air. This is a distinguishing characteristic of the Davison invention; without it the Davison invention is not utilized and the presence of this automatic regulation is a fairly conclusive indication that the Davison invention is utilized.

The special object that Davison had in view was increasing the range of automobile torpedoes and he demonstrated that his invention was effective in attaining that object. He obtained from the Navy one of the old torpedoes of the outside superheater type and substituted his steam generator in it and *the torpedo whose range had previously been 4000 yards ran over 6000 yards* (Finding XI, Rec., pp. 20-21); and had the engine and the other parts of the torpedo been in good condition, instead of

being badly worn, the run would have been much greater.

The Davison patent should now be considered, but, preliminary thereto, it would be well to consider briefly two of the prior art patents which represent stages in the evolution of the modern torpedo prior to the Davison invention.

The figure at the top of the sheet opposite page 18 illustrates the simple form of automobile torpedo driven by compressed air, as used in the navies of the larger nations up to about 1900.

The torpedo is cigar-shaped as usual and at its forward end is a chamber A in which the explosive is carried. Directly back of this is a chamber B for the storage of the compressed air whose initial pressure may be as high as 2250 pounds per square inch. At the aft end of the torpedo, back of the air chamber, is a chamber for the steering gear, the depth regulating gear, the engine and the associated parts. The engine is indicated at C; it may be a turbine or a reciprocating engine. In either case, it is connected to two concentric shafts carrying the two propellers at their rear ends. The compressed air flows from the chamber B to the engine C through a pipe D as indicated, and in this pipe is a reducing valve E which operates automatically to reduce the pressure of the air from the high and steadily declining pressure existing in the chamber B to a lower and constant pressure of say 300 pounds, at which the air is utilized by the engine. This represents the simple form of cold, compressed-air torpedo mechanism which was in general use up to about 1900 (Rec., p. 9, Finding IV).

In the evolution of the modern construction, this cold air type was succeeded by the inside super-

heater type disclosed in the Leavitt patents, Exhibits C-2 and C-3. The second figure on the accompanying sheet is a reproduction of Fig. 1 of the Leavitt patent No. 693,872, Exhibit C-3, Rec., fol. pp. 60-66).

This is like the cold air construction illustrated above except that the superheater has been added. Within the chamber B for the storage of compressed air is a burner F which is supplied with alcohol or other liquid fuel from a tank G by means of a pipe H. The alcohol is ignited automatically at the beginning of a run of the torpedo, and throughout the run, the alcohol is supplied to the burner at a rate which is governed by the pressure of the air existing within the chamber B. In this way, the air utilized for driving the propelling engine is heated prior to being utilized so as to increase its pressure, this air flowing, as before, through the pipe D and reducing valve E to the engine C. Aside from the danger incident to the use of this inside superheater, its primary deficiency from an operating standpoint resides in the limitation, inherent in its structure, to a relatively small use of the energy of combustion. In no event can the heat of combustion be utilized in sufficient degree to increase the pressure in the air flask above the initial pressure, for then it might burst the torpedo shell. This inside superheater construction was utilized by the United States Navy between the years 1901 and 1909 (Rec., p. 9, Finding IV.)

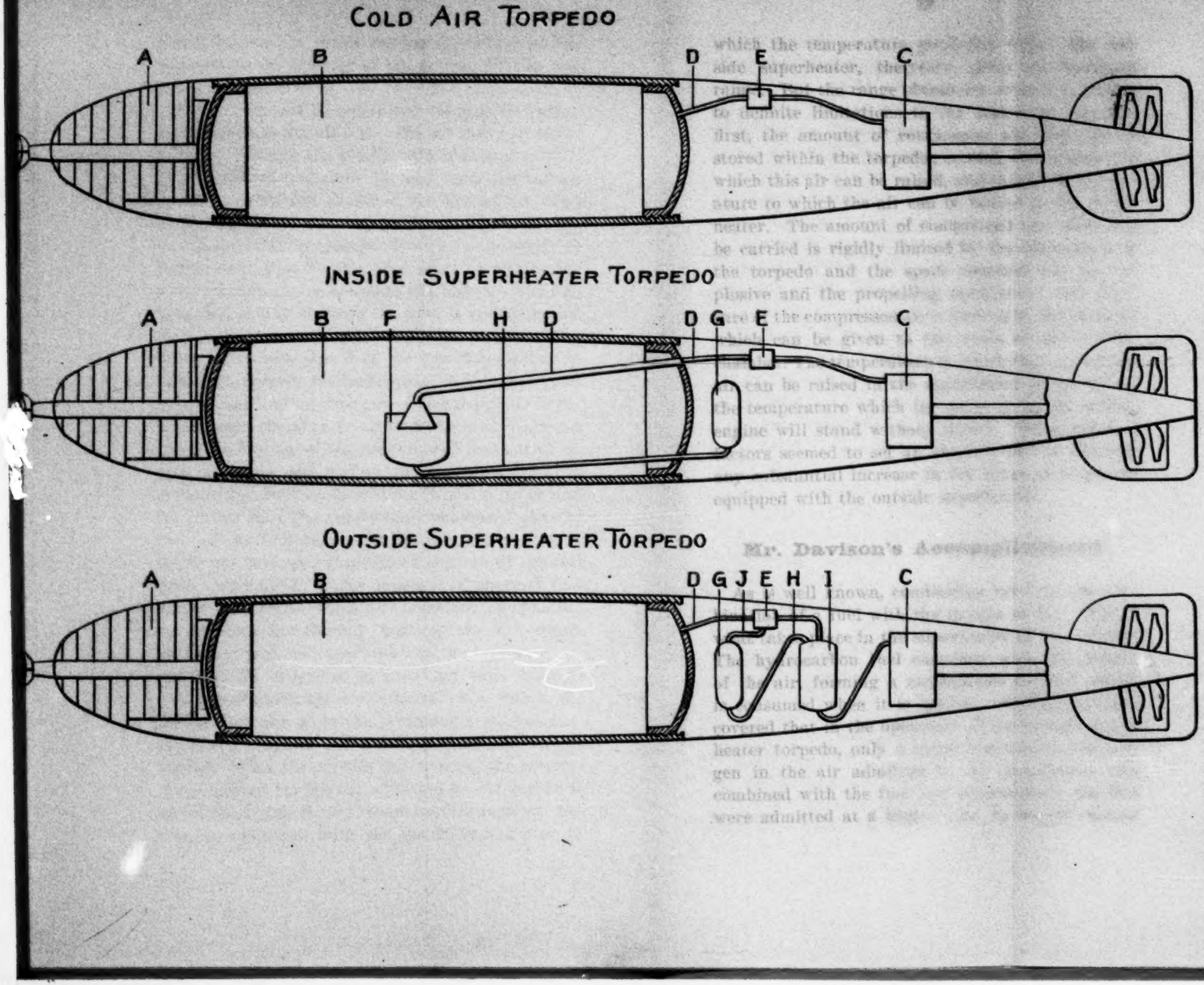
In 1908, the Navy adopted the outside superheater which is represented by the Sodeau British patent No. 15997 of 1906, Exhibit C-8.

The third sketch on the accompanying sheet shows the torpedo of the Leavitt patent illustrated

above, having the inside superheater removed and the outside superheater of the Sodeau British patent installed.

First, it should be noted that there is no burner within the air chamber B. The air flows from the chamber through the pipe D and reducing valve E to a combustion chamber I; and from the bottom of this combustion chamber, the heated air flows to the engine C. Alcohol or other fuel is supplied to the combustion chamber from a container G by means of a pipe H; this pipe leads to a spraying nozzle within the combustion chamber I. The fuel is caused to flow through the pipe H and its nozzle by compressed air which passes from the reducing valve E through pipe J to the top of container G. When the torpedo is discharged, the reducing valve E is opened and air flows through the pipe D to the combustion chamber I; also, air flows through the pipe J to the top of the container G and exerts its pressure upon the fuel in the container, thereby causing the fuel to flow through the pipe H and its nozzle into the combustion chamber. As the flow of the fuel begins, an igniter is actuated to ignite the fuel, and throughout the run of the torpedo, combustion of the mixture of sprayed fuel and air takes place within the combustion chamber or superheater, thereby heating the air which passes through the superheater to the engine.

It will be recognized at once that with this outside superheater, the air is heated, not within the air-storage tank as in the preceding type, but during the passage of the air from that tank to the engine. With the outside superheater, the temperature desired for the air admitted to the engine is maintained practically constant throughout the run, as compared with the inside superheater in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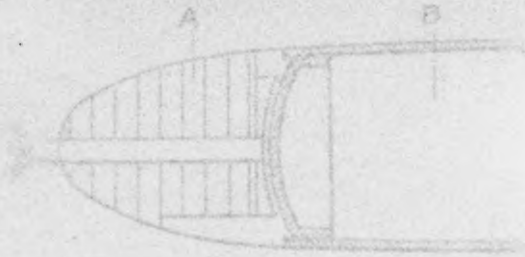
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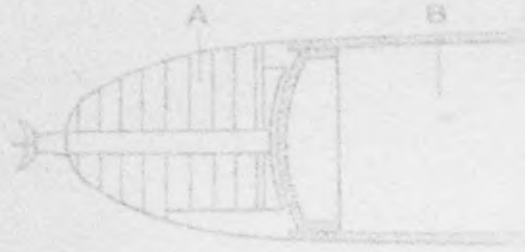
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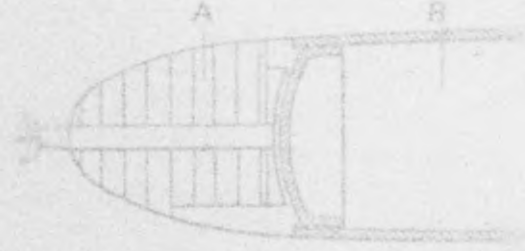
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which the temperature gradually falls. The outside superheater, therefore, gives an increased range. But the range obtainable with it is subject to definite limitations in the following respects: first, the amount of compressed air that can be stored within the torpedo; second, the pressure to which this air can be raised, and third, the temperature to which the air can be heated in the superheater. The amount of compressed air which can be carried is rigidly limited by the dimensions of the torpedo and the space required for the explosive and the propelling machinery. The pressure of the compressed air is limited by the strength which can be given to the walls of the storage chamber. The temperature to which the compressed air can be raised in the superheater is limited by the temperature which the parts of the propelling engine will stand without injury. These limiting factors seemed to set an absolute bar to effecting any substantial increase in the range of torpedoes equipped with the outside superheater.

Mr. Davison's Accomplishment.

As is well known, combustion involves the combination of a fuel with the oxygen of air. This is what takes place in the superheater of the torpedo. The hydrocarbon fuel combines with the oxygen of the air, forming a combustible mixture which is consumed when it is ignited. Mr. Davison discovered that in the operation of the outside superheater torpedo, only a small fraction of the oxygen in the air admitted to the superheater was combined with the fuel and consumed; if the fuel were admitted at a higher rate, to supply enough

fuel for combination with all or a large proportion of the oxygen in the air admitted to the superheater, then the temperature of the products of combustion passing from the superheater to the engine would be so high as to melt the metal of the engine. Thus, the temperature which the engine would stand without injury made it essential that the fuel be supplied to the superheater at such a low rate as would result in utilizing for combustion only a small fraction of the oxygen in the air admitted to the superheater. Mr. Davison reasoned from this that if something could be done to permit of utilizing all of the oxygen in the air for combustion without developing too high a temperature, a motive fluid of greater expansive power would be developed and the range of the torpedo would be correspondingly increased. How to do this was the problem which confronted him, and he solved it by providing for the admission of water to the combustion chamber which water would be heated by the hot products of the combustion of the fuel and air, thereby vaporizing the water to form steam whose expansive power would be equal to that of the hot products of combustion and whose temperature would be low enough to permit of admitting it to the engine with entire safety. His conception went even further; it contemplated not only the possibility of using all the oxygen in the air for combination with the fuel, but also the enrichment of the air admitted to the combustion chamber by increasing its proportion of oxygen so that there would be an even greater amount of oxygen present for combination with the fuel. As is well known, atmospheric air contains less than 25 per cent of oxygen, the remainder being nitrogen which does not enter into combustion

and Mr. Davison's conception involved the use of air enriched to contain far more than 25% of oxygen or even pure oxygen.

In this way, Mr. Davison swept aside completely the barrier formed by what seemed to be absolute limitations upon the range possibilities of the air-driven torpedo. Where it had been considered impossible to use more than a small fraction of the oxygen in the air for combustion, for fear of burning up the engine, he made it possible to use all of the oxygen in the air and even to put more oxygen into the air and use that. He transformed the old outside superheater, such as that described in the Sodeau British patent, into a steam generator. The product issuing from this generator and passing to the engine, instead of being heated air, is a mixture of steam and the gases of combustion, and even though fuel be burned in such quantity as to consume all of the oxygen in the air admitted to the generator chamber, still the product passing from the chamber to the engine is at such a relatively low temperature as to eliminate the possibility of injury to the engine. Mr. Davison's steam generator is similar in its general structural features to the outside superheater previously used and fuel is admitted to it and burned in it as had been done in the outside superheater. But in addition to the fuel spray, provision is made for spraying water into the hot products of the combustion taking place within the chamber, whereby those products are cooled down to a safe temperature and steam is generated to supply the desired motive fluid.

Furthermore, Mr. Davison's invention included a simple and practical means for attaining an essential attribute of success in the practical application

of the steam generator to torpedo propulsion, namely, the admission of the air, fuel and water to the steam generator *in definite proportions.* An excess of air would result in decreased efficiency; an excess of fuel would result in waste and either dangerously high temperature or the flow of liquid fuel into the engine; and an excess of water would result in water passing into the engine and might even cause discontinuance of the combustion. So Davison provided means for insuring the maintenance of the proportions of air, fuel and water which were found by calculation and experiment to be conducive of the best results, *by making the feed of the fuel and water into the steam generator depend upon the pressure of the air, and hence upon the rate of flow of air into the generator.*

That Mr. Davison's achievement constituted an invention of high order is shown in most convincing manner by established facts. Extending the range of automobile torpedoes had been a problem confronting the Navy for years, in fact, throughout the history of the torpedo (Finding V, Rec., p. 10). But since the use of torpedoes of the steam generator type embodying the Davison invention, this problem has been completely solved. Any greater range than that attainable with the steam generator torpedo is not desired, for accuracy in the operation of the steering gear cannot be attained at distances beyond the torpedo's present range.

Considered broadly, the Davison achievement was the elimination of the problem of range in torpedo manufacture. Considered more specifically, three facts stand out pre-eminently on the record before the Court as tributes to the Davison invention.

First, Mr. Davison applied his steam generator to an existing torpedo of the type using the outside superheater, and when the torpedo so modified was tried on a test run, it covered a range of over 6,000 yards, whereas its range before being equipped with the steam generator was only 4,000 yards (Finding XI, p. 21).

Second, a torpedo made by the Bliss Company, equipped with the steam generator and embodying the invention of the Davison patent, attained a range of 10,000 yards at 26 knots per hour (Finding VIII, p. 14); and the torpedoes of the steam generator type which the United States Navy has been using since then have a range of double that of the outside superheater type which was superseded by the steam generator type (Finding IV, p. 9).

Third, beginning about a year after Mr. Davison's work, the torpedo station of the United States Navy at Newport endeavored to solve the range problem by developing a steam generator. After experimentation extending over a period of more than eight months, the torpedo station reported that though "several methods of vaporizing the liquid have been experimented with," still "the best method of introducing the water has yet to be ascertained." So, after all of this concentrated effort of the Newport Torpedo Station upon solving the range problem by the use of the steam generator, the station was forced to admit that it had not yet been able to find the best method of introducing the water; and because of that, it was decided that in further work alcohol would be used as a fuel and there would be "no injection of water" or generation of steam (Finding V, pp. 10-11).

The Davison Patent.

With this preliminary explanation, the Davison patent should be readily understood. The introductory paragraph of the specification covers, in condensed form, the explanation above given. It reads as follows (Rec., p. 25):

> "In the operation of automobile (or self-propelled) torpedoes, it would be of great advantage to substitute for the compressed air commonly used as a motive fluid, a motive fluid derived by burning a suitable fuel with compressed air or oxygen and then injecting into the highly heated products of combustion a quantity of water, whereby the water is converted into steam, adding to the volume of the fluid and reducing its temperature. In this way there may be formed a motive fluid under extremely high pressure and at moderate temperature, which is admirably adapted to the operation of the light, high-speed, powerful engines which are used on such torpedoes; and a very high degree of efficiency of energy transformation may be secured; *provided an apparatus can be devised which is of the requisite simplicity in construction and regulation, so that it may be used without danger and with the assurance that it will be in operative condition whenever it may be called upon to do its work*" (Italics ours).

Following this is the usual detailed description of one construction in which the invention may be embodied. The drawings illustrating this construction show an arrangement suitable for actual use. This construction may be illustrated diagram-

matically to facilitate explanation of it, as it is at the top of the sheet opposite page 36, to which reference will now be made.

CONSTRUCTION.

This sketch shows the usual chamber *a* for storing compressed air and the air flows from the chamber through a pipe *c*, reducing valve *d* and pipe *e* to the generator chamber *f* and from this chamber *f* the motive fluid flows by pipe *g* to the engine *s*, in substantially the same manner as in the outside superheater type of torpedo. The fuel is supplied to the generator from a container *b* through a pipe *y*, also as in the outside superheater type.

In supplying water to the generator, Davison decided to draw the water from the sea in which the torpedo is immersed rather than carry the supply of water within the torpedo; this saved much of the space required for the water tank and guarded against change of balance of the torpedo as the water supply was consumed. Of course it makes no difference where the water comes from; it may, to equal advantage, be stored in the torpedo or introduced from any available outside source. But as Davison decided to draw it from the sea, he provided a pump as shown at *t* connected to the exterior of the torpedo by a pipe t^1.

As already stated, it is of the utmost importance that the supply of the water and the fuel to the generator shall be under the control of and therefore proportionate to the air flowing to the generator. It is immaterial to the invention how this is done, the claims only requiring that it shall be done in some way. Davison's specific way was to provide a regulator as shown at *u*, connected to the pump *t* by a pipe *x* so as to receive water from

the pump. From this regulator, the water flows by a pipe k to the generator chamber f. Also the water flows from the regulator by pipe t^2 to the bottom of the container b for the fuel so as to force the fuel out through pipe y.

The inlet for water from the pump t to the regulator u through the pipe x is controlled by a valve indicated at w, actuated by a rubber diaphragm u^1 in the regulator and the space at the top of the regulator above the diaphragm is connected to the air pipe e by means of a branch pipe e^1. Thus this valve is controlled by the joint action of the air pressure entering the top of the regulator through pipe e^1 and the water entering the bottom of the regulator through pipe x from pump t.

It is in this way that the pressure of the air flowing to the generator chamber, and hence the rate of flow of that air, regulates the rate of flow of the fuel and water to the generator chamber. The air pressure governs the extent of the opening of the inlet to the regulator u and hence the freedom of flow of water from the pump t into the regulator. Part of this water flows from the regulator directly into the generator by pipe k and part of it flows by pipe t^2 into container b and thus forces the fuel out of the container and by pipe y into the generator. Thus the air, fuel and water flow into the generator chamber under a common control and therefore these three ingredients of the motive fluid will always be supplied in fixed proportions.

Within the generator chamber, the fuel is ignited and burns in combination with the oxygen of the air, and water is sprayed into the hot prducts of the combustion, vaporizing the water to form steam and reducing the temperature to within workable limits, and the steam so generated forms part of the

motive fluid which flows through pipe *g* to the engine *s*.

The three figures at the bottom of the sketch sheet opposite page 36 are reproductions of the drawings of the Davison patent and show the apparatus as designed for construction. At the left of Fig. 1 is the rear end of the storage chamber *a* for compressed air. Immediately back of this is a chamber for fuel formed by the partition *b*. A pipe *c* extending through the fuel tank carries the air back to the reducing valve *d* and then the air flows by pipe *e* to the generator chamber *f*. From the bottom of this generator chamber *f*, a pipe *g* carries the motive fluid to the propelling engine *s* at the extreme rear.

Next in front of this engine is the pump *t* which draws water from the sea through the connection t^1, at the base of the pump. The water drawn in from the sea through this connection is forced out by the pump through a connection *x* by which the water flows to the regulator *u*. One of the water connections leading from this regulator is indicated at *k*; it extends to the top of the generator chamber *f*. The other water connection from the bottom of the regulator *u* is a pipe t^2 which extends through the partition *b* to a point near the bottom of the fuel chamber and the water admitted to the fuel chamber through this pipe connection forces the alcohol or oil, which is lighter than the water, up and out through pipe *y*. This pipe is shown as extending into the top of the generator chamber *f*.

One further pipe connection is to be noted. It is the pipe e^1 extending from the air pipe *e* to the top of the regulator *u*.

Fig. 2 is a longitudinal section of the generator chamber. At the center of the top is a connection including three concentric tubes *n*, *m* and *i*, through

which the fuel, air and water are admitted to the generator. Inside the generator is a hood *o*. The fuel is sprayed into the space within this hood by the nozzle n^1 and the air flows in around this spraying nozzle. The water is admitted through the pipe *k*, sleeve *i* and radial openings *l* above the hood *o* and it flows down over the hood, being heated meanwhile, and as it does not come into contact with the fuel until combustion is complete, there is no danger of the water extinguishing the flame. The parts shown at the left of the spraying nozzle just described constitute an igniter which is operated automatically to ignite the mixture of fuel and air. At starting, the first operation is to open the air connection from the storage chamber through the reducing valve to the generator and the pressure of the air so admitted to the generator chamber actuates the igniter. The flow of fuel into the chamber follows almost immediately thereafter and then ignition takes place.

The regulator heretofore referred to, by which the feed of the water and fuel into the generator chamber is placed under the control of the air and is therefore made proportionate to the flow of air into the generator chamber, is shown in section in Fig 3. An elastic diaphragm is indicated at u^1 and the space above this diaphragm receives the air from the main air conduit through the branch pipe e^1. The space below the diaphragm is filled with water entering the regulator by the pipe *x* leading from the pump. The water flows out from the regulator through the pipes *k* and t^2, the pipe *k* leading to the generator chamber, and the pipe t^2, leading to the fuel tank. The pressures of the air and water act on opposite sides of the diaphragm u^1 and thus serve to position it. This diaphragm is secured to a rod *r* which is connected by a lever to a valve *w*

controlling the entrance of water from the pipe x to the interior of the regulator. When the air pressure preponderates, diaphragm u^1 and rod r are moved downwardly and the valve w is opened somewhat, allowing water to enter more freely and increasing the pressure on the lower side of the diaphragm u^1. This tends to move the diaphragm upwardly and close the valve w somewhat. In this way, the pressures of the water and air on opposite sides of the diaphragm u^1 act constantly throughout the run of the torpedo to effect automatic regulation of the position of the valve w, and as a result, the rate of flow of water through the regulator and the pipes t^2 and k. Therefore, the rate of flow of water and fuel into the generator chamber is at all times dependent upon the air pressure in the pipe e and hence upon the rate of flow of air into the generator chamber.

Operation.

The operation of the mechanism thus described may be summarized by reference to either the simplified drawing or Fig. 1 of the drawings of the patent.

When the torpedo is launched, the starting lever is actuated to release the reducing valve d and air flows from the compressed air storage chamber a through the pipe c to the reducing valve. This air is at very high pressure but the reducing valve operates automatically to allow air to pass therefrom at a substantially uniform pressure. The air passes through the pipe e into the generator chamber, and then through the pipe g to the propelling engine s to operate that engine initially as a cold compressed air engine. Air from the generator f also passes through a branch pipe h (not shown on

the simplified sketch) to the power cylinders of the pump t and this pump is likewise started in operation. Air from the pipe e also passes through the pipe e^1 to the upper chamber of the regulator and its pressure is exerted upon the flexible diaphragm u^1 to move that diaphragm and its attached rod r downwardly and thus open the valve w. When the pump t is started in operation, it forces water through pipe x and into the regulator u through the open valve w. After the regulator has been filled, water passes through the pipe t^2 into the bottom of the fuel chamber and serves to force the liquid fuel in that chamber through the pipe y into the top of the generator through the spraying nozzle n^1, and the fuel issuing from this spraying nozzle is mixed with the air entering the chamber around the nozzle to form the combustible mixture. Also the air admitted to the generator chamber actuates the fuse q and causes it to ignite and the fuse burns for several seconds so as to insure ignition of the fuel when admission of the fuel to the generator chamber begins. The combustion of the fuel admitted through the spray nozzle n^1 and the oxygen of the air admitted around the nozzle develops hot combustion products within the generator and heats hood o. Water forced into the regulator chamber u also passes out through the pipe k and enters the top of the generator chamber in a spray directed radially outward into the space between the hood o and the top of the generator. This water passing down over the hot hood in a spray and mingling with the hot products of combustion, is vaporized, and the steam thus generated flows out through the pipe g to the engine s to continue it in operation, and flows out through the pipe h to the pump t to continue its operation.

The summary of the operation of the mechanism appearing in the patent, reads as follows (Rec., p. 28):

> "The operation of the system as a whole is as follows: When the torpedo is launched the valve *d* is opened automatically and the oxygen-carrier at the predetermined pressure is admitted to the upper portion of the generating chamber through the pipe *m*. The pressure thus produced in the generating chamber forces the fuse-carrier up the bore of receptacle *p* against the firing projection and ignites the fuse. The fuse contains a slow burning composition, preferably one which will burn for several seconds, and before it is burned out, the pump, actuated initially by the oxygen-carrier passing through pipe *h*, will force fuel through the nozzle *n* into the generator, there forming an explosive or combustible mixture which will be ignited by the fuse. At the same time, or substantially the same time, that the fuel is admitted, jets of water will be thrown with a circumferential or whirling motion from the sprayer head *l* into the space between the hood *o* and the body of the generator, and as the hood heats up and the hot products of combustion accumulate, the water will be vaporized and mixed with the products of combustion, but by reason of the interposition of the hood *o* the combustion will be complete before the mixture takes place so that the water cannot interfere with the combustion. The mixed products of combustion and water vapor in the lower portion of the generator pass through the pipe *g* to the engine and through the pipe *h* to the pump."

Two points of primary importance should be noted in the operation of this mechanism. First, there is no occasion for limiting the amount of fuel which may be admitted to the generator for combustion with the oxygen of the air to avoid danger of developing excessive temperatures which would injure the mechanism beyond the generator. Fuel may be admitted in such large quantity that all of the oxygen in the air admitted will be utilized in combining with the fuel to form a combustible mixture. It does not matter how high the temperature of the products of combustion may go; in fact, the higher it goes, the better. The reason for this is that the hot products are reduced in temperature by the water which is admitted, for this water absorbs heat from the combustion products and in doing so is vaporized, thereby producing steam which is equally available for the operation of the engine, which conserves the energy in the hot combustion products, and which is at such a temperature as to permit it to be introduced into the engine with entire safety.

The second point of primary importance is that the feed of the fuel and water to the generator is regulated in direct proportion to the rate of flow of air into the generator. This, in Davison's specific embodiment of his invention, is effected by the automatic regulator. The rate at which air enters the generator *f* is dependent upon the pressure of the air passing through the reducing valve and the pressure existing within the generator. The greater this difference of pressure, the higher will be the rate of flow of the air. The reducing valve *d* may be adjusted to regulate as desired the pressure of the air passing from the valve; in practice, it is common to so adjust the valve as to produce a pres-

sure of 350 pounds per square inch at this point (Rec., p. 31). The pressure existing within the generator *f* depends primarily upon the construction of the engine *s;* this pressure may be about 300 pounds. Under those conditions, there would be a difference of pressure of 50 pounds tending to cause the flow of air through the pipe *e* and into the generator *f*. This difference of pressure may be caused by any restriction in the pipe *e*. Thus, in figure 2 of the drawings of the patent, the air passage is shown as restricted at the point where it passes between the tubes *m* and *n*, and this restriction occasions the drop of pressure of 50 pounds, just as contracting a rubber hose by pressing on opposite sides of it restricts the flow of water through the hose and reduces the pressure of the water beyond the restriction.

As long as these conditions prevail, namely, a pressure of 350 pounds in the air passing through the reducing valve, and a pressure of 300 pounds within the generator, air flows through the pipe *e* and into the generator at a definite and fixed rate corresponding to a pressure difference of 50 pounds. This same pressure of 350 pounds of the air passing through the reducing valve is exerted upon the upper surface of the flexible diaphragm w^1 of the regulator by reason of the open connection from the pipe *e* to the regulator through the pipe e^1. Also, this diaphragm, positioned by the air pressure exerted thereon, operates the valve *w* for throttling, more or less, the flow of water from the pump *t* through the pipe *x* into the regulator. *The pressure of the water in the regulator u must, therefore, bear a definite relation at all times to the pressure of the air in the pipe e, that is, the pressure of the air passing through the reducing valve.*

If the pressure of the water in regulator *u* rises, the flexible diaphragm u^1 moves upwardly and the valve *w* moves toward its closed position to restrict the freedom of flow of water from the pump into the regulator; on the other hand, if the pressure of the water in the regulator falls, the diaphragm u^1 moves downwardly under the air pressure and opens the valve *w* wider to increase the freedom of flow of water from the pump into the regulator.

Thus, this definite relation of the water pressure in the regulator to the air pressure in the pipe *e* is always maintained throughout the operation of the apparatus. And this pressure within the regulator *u* serves to force water through the pipe *k* and into the generator *f*. The rate of flow of water into the generator is, therefore, at all times dependent upon the difference between the pressure within the regulator *u* and the pressure within the generator *f*. But as the pressure of the water in the regulator *u* is dependent upon the pressure of the air in pipe *e*, the feed of the water into the generator is dependent upon the pressure of the air in pipe *e*, and must necessarily bear a definite relation to the rate of feed of air into the generator *f*. Likewise, the pressure of the water in regulator *u* is exerted through the pipe *t*2 upon the fuel in the fuel reservoir, and causes the feed of the fuel through pipe *y* into the generator. Therefore, the feed of the fuel, being governed by the regulator *u*, must also be dependent upon the air pressure in pipe *e*, and must bear a definite relation to the rate of feed of air into the generator. This mechanism, therefore serves to regulate automatically the rate of feed of fuel and water into the generator, in direct relation to the rate at which air is supplied to the generator; in other words, these three ingre-

dients enter the generator in fixed proportions, and so long as the mechanism operates in the intended manner, no change in the rate of supply of any one of the ingredients to the generator can occur without a corresponding change in the rate of feed of the other two ingredients.

For instance, if faulty operation of the parts were to cause a cessation of the flow of air through the pipe c to the generator, the feed of water and fuel would cease at once, for the diaphragm u^1, relieved of air pressure on its upper surface, would move upwardly, with the result that the valve w would close entirely and the entrance of water into the regulator u would cease. Also, it will be noted that the feed of the fuel and water is effected by the same pump t. It follows that fuel cannot be forced into the generator unless water is also forced into the generator; this eliminates the possibility of developing a dangerously high temperature due to the combustion of fuel in the generator when no water is present to reduce the temperature of the combustion products and generate steam. Furthermore, as the fuel supply in the fuel chamber becomes diminished, its place is taken by water, thus avoiding the production of an air space adjacent to the fuel in which an explosive mixture might be formed. Lastly, it will be noted that if the supply of water to the generator ceases, the supply of fuel to the generator will also cease, and air flowing into the generator through the pipe e may pass on through the pipe g to the engine s to operate the engine as a cold, compressed air engine.

These characteristic features of the mechanism illustrated and described in the patent are pointed out on page 2 of the patent (Rec., p. 27), as follows:

"With this construction and arrangement of parts, the pressure of the oxygen-carrier in the pipe *e* on the low pressure side of the reducing valve *d* controls absolutely the pressure on the fuel and the pressure on the water supply to the generating chamber, so that the oxygen-carrier, the fuel and the water are fed always at a predetermined pressure to the generating chamber, and if, for any reason, the supply of oxygen-carrier is cut off or exhausted, the supply of fuel and water to the generating chamber will cease at once, while, as long as there is a supply of oxygen-carrier under pressure and the flow of water into the regulator chamber is not interrupted, the supply of fuel and water to the generating chamber will continue under proper control. Furthermore, by this arrangement the fuel in the fuel tank, as it is withdrawn, is replaced by water, which, of course, remains at the bottom of the tank. This prevents a possibility of the admission of air or oxygen into the fuel tank and the formation therein of an explosive mixture. But a single pump is necessary to feed both the fuel and the water and it is made certain that the fuel and the water will be fed under the same pressure and will both be controlled by the pressure of the oxygen-carrier. This dependence of the fuel supply upon the water supply, and their mutual dependence upon the single pump and the pressure of the oxygen-carrier, is of further advantage in that it is impossible that the water supply should be stopped and the fuel supply continued, thereby creating unduly high temperatures in the generating chamber and engine. Further-

more, it will be observed, the arrangement is such, that if for any reason, such as the breaking down of the power pump, the flow of water into the regulator chamber is interrupted, the supply of fuel will immediately cease, thus bringing the combustion to an end and preventing unduly high temperatures. In the meantime, however, the air or oxygen under pressure will continue to flow from the storage cylinder through the combustion chamber to the atmosphere, and the torpedo will continue to be driven until the supply of oxygen-carrier under pressure is exhausted."

The Question Presented in This Suit.

The claims of the Davison patent relied on in this suit are those numbered 1, 5, and 12. An extended discussion of them at this point is unnecessary; it is sufficient to state that they are directed to the steam generator system which we have described in detail, wherein air, fuel and water are supplied to the generator chamber for combustion of the fuel and air and generation of steam from the water, and wherein the feed of the fuel and water depends at all times upon and is automatically regulated by the pressure of the air. These claims constitute a definition, in brief, of the accomplishment in the controllable torpedo invented by Mr. Davison and described at length in the patent.

The sole question presented by this suit is whether or not [illegible] the automobile torpedo [illegible] partment. No [illegible]

DAVISON STEAM GENERATOR TORPEDO

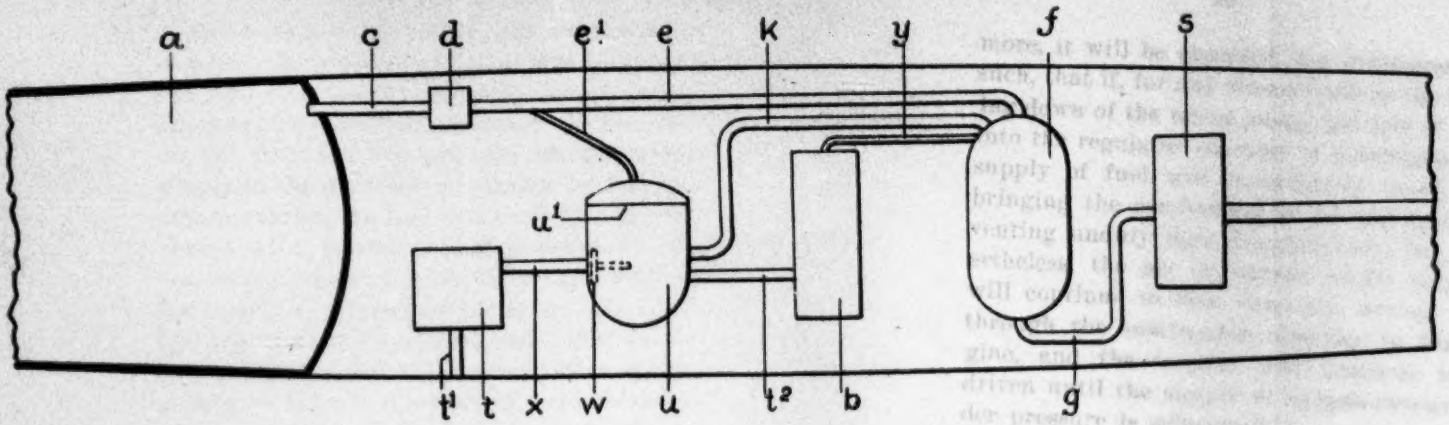
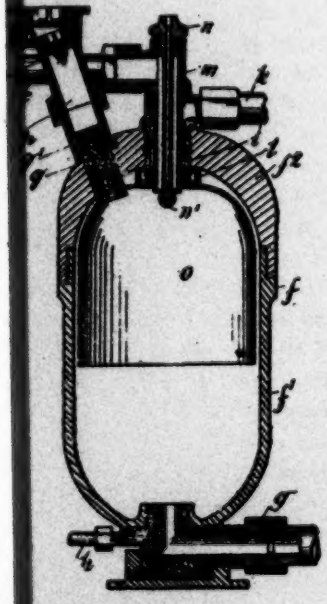


FIG. 2.



DAVISON PATENT

FIG. 1

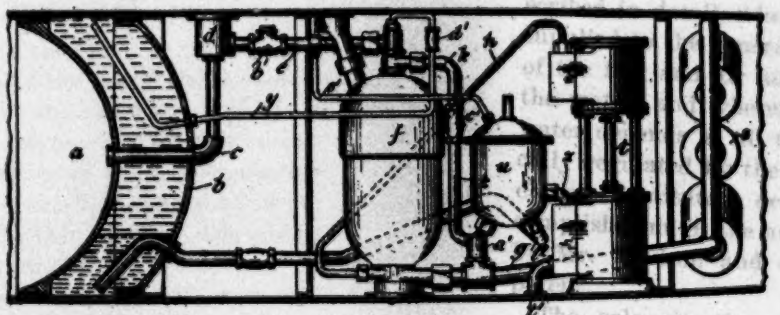


FIG. 3.

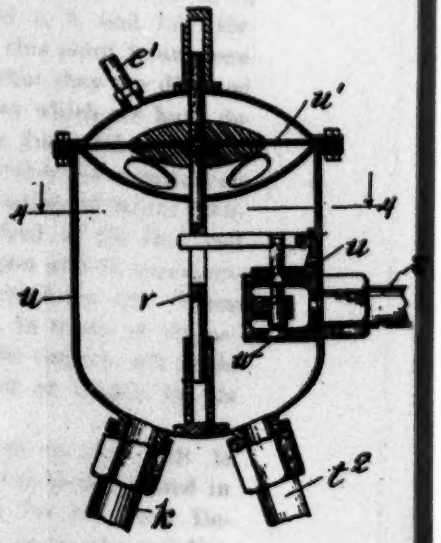


Fig. 2.

more, it will be observed, the arrangement is such, that if, for any reason such as the breaking down of the water pump, the flow of water into the regulator chamber is interrupted, the supply of fuel will immediately cease, thus bringing the combustion to an end and preventing unduly high temperatures; but, nevertheless, the air or oxygen under pressure will continue to flow from the storage tank through the combustion chamber to the engine, and the torpedo will continue to be driven until the supply of oxygen-carrier under pressure is exhausted."

The Question Presented in This Suit.

The claims of the Davison patent relied on in this suit are those numbered 1, 5, and 13. Extended discussion of them at this point is unnecessary; it is sufficient to state that they are directed to the steam generator system which we have described in detail, wherein air, fuel and water are supplied to the generator chamber for combustion of the fuel and air and generation of steam from the water, and wherein the feed of the fuel and water depends at all times upon and is automatically regulated by the pressure of the air. These claims constitute a definition, in brief, of the accomplishment in the automobile torpedo art made by Mr. Davison and described at length in his patent.

The sole question presented in this suit is whether or not this invention has been utilized in the automobile torpedoes made for the Navy Department. No question arises as to the validity

of the Davison patent because appellee is a licensee under the patent.

In *Eclipse Bicycle Co.* vs. *Farrow*, 199 U. S., 581; 50 L. Ed., 317, this Court said:

> "The use of the word 'invention' does not open the state of the art and allow the defendant to meet the plaintiff's claim by proving that he had invented nothing new."

This rule, announced and enforced in many cases, was held to apply in a suit against the United States in *Harvey Steel Company* vs. *United States*, 196 U. S., 310; 49 L. Ed., 492.

Therefore, it remains only to consider appellee's torpedo and ascertain whether or not it embodies the invention made by Mr. Davison and covered by claims 1, 5 and 13 of the Davison patent. Appellee's construction is adequately illustrated and described in Exhibit III (Rec., pp. 31-2) and the Davison patent must be construed, particularly with respect to the claims indicated, to determine whether or not appellee's construction falls within it.

This is a question of law to be decided by the Court, in accordance with *Singer Manufacturing Co.* vs. *Cramer*, 192 U. S., 265, 275; 48 L. Ed., 437, 444. In the Singer case, this Court considered the record of the proceedings in the Patent Office leading up to the grant of the patent in suit and various patents of the prior art and by reference thereto fixed the scope of the patent in suit, and then determined whether or not the defendant's construction was within the patent, saying, by Mr. Justice White:

> "the question of infringement or no infringement is one of law, and susceptible of determ-

carrying motive fluid from the generator chamber D to the steering engines. These parts, however, have no direct bearing on the issues of this suit.

The operation, in all respects except the most specific ones, is precisely the same as that above described in connection with the Davison patent. When the torpedo is discharged, a starting lever is actuated which releases the reducing valve C. Air at the high pressure existing within the reservoir A then flows through the pipe B to the reducing valve C and passes through that valve, the air flowing from the valve being at the reduced and substantially uniform pressure of 350 pounds. This air at the reduced pressure passes from the reducing valve C into the top of the generator D, through the generator and through the pipe T to the nozzles at the end of pipe T which direct the air upon the wheels 53 of the turbine to drive the turbine and the propellers to which it is connected, thereby propelling the torpedo through the water. For a few seconds at the beginning of the run, the torpedo is propelled by compressed air in this manner, the turbine engine operating as a cold air engine. At the same time, air from the low pressure side of the reducing valve C and at the reduced pressure of 350 pounds, passes through the pipe G and the pipes H and J to the water and fuel reservoirs O and P, so that the liquids in these reservoirs are subjected to the pressure of that air, namely, a pressure of 350 pounds. Actuated by this pressure, the water and fuel flow out through the pipes M and N to the top of the generator chamber D. Within that chamber, the fuel mixes with the air to form a combustible mixture and this mixture is ignited by the igniter or pistol U on the top of the generator chamber. The hot

products of the combustion of the air and fuel mingle with the water admitted through the pipe M, thereby generating steam which passes through the pipe T to the turbine. All of these operations preliminary to the generation of steam within the generator D take place almost instantaneously, and thereafter, throughout the run of the torpedo, steam is developed in the generator D and flows to the turbine to operate the latter.

The construction of individual parts shown on Exhibit III, is illustrated by Exhibits B-1, B-2 and B-3. Exhibit B-1 (Rec. opposite p. 37) shows the reducing valve. The high pressure air enters at B, flows past a control valve 14 which is lifted when the mechanism starts, then past a valve-member Z, then into and through a chamber Y, and then through the perforation in a washer J and into the generator chamber. The valve-member Z controls the reduction of the pressure of the air. It is provided with a tapered surface which coacts with a similar-shaped valve-seat shown at V in the detached view in the lower right hand corner of the exhibit. This valve-member Z moves within narrow limits during the operation of the apparatus, under the control of the air pressure and a coiled spring 17 in the lower part of the reducing valve casing 12, and it allows the high pressure air to pass the valve-member at such a rate that the pressure beyond the valve-member in the chamber Y is maintained uniform and at the desired point, namely, 350 pounds.

Exhibits B-2 and B-3 illustrate the construction of the generator chamber. In its upper portion is a perforated baffle-plate 35. The air from the reducing valve enters the space above this baffle-plate and passes through the perforations in it. The fuel is sprayed into the space immediately be-

low the baffle-plate by the fuel inlet nozzle illustrated at 26. The fuel becomes intimately mixed with the air and the mixture thus formed is ignited by the pistol 22. Water is admitted to the generator chamber by the water spray device which is illustrated at 28.

The turbine engine and the pipe T leading from the generator to the engine are so constructed that the pressure within the generator chamber D is maintained practically constant and at a point somewhat below the pressure of the low pressure air passing through the reducing valve. In practice, the pressure within the generator D is about 300 pounds and any rise in pressure above that point results in higher speed of operation of the turbine which brings the pressure down to 300 pounds at once. Thus, there is a drop in pressure of 50 pounds from the low pressure side of the reducing valve, that is, the chamber Y where the pressure is 350 pounds, to the interior of the generator. This drop in pressure is due to the fact that there is a restriction in the air passage from the reducing valve to the generator. This restriction occurs at the perforated washer J, Exhibit B-1, which is inserted between the reducing valve casting and the generator casting; it will be noted that the passage through this washer J is materially smaller than the air passage Y on the low pressure side of the reducing valve. It is this drop of pressure of 50 pounds, which causes the air to flow from the reducing valve into the generator. Also, it is to be noted particularly that this same pressure of 50 pounds is effective upon the fuel and water to feed them into the generator, because the pipe G, Exhibit III, is connected to the low pressure side of the reducing valve at the opening W shown on Exhibit B-1. In other words, air at the pressure of 350 pounds existing within chamber Y

passes through the opening W and the pipe G to the fuel and water receptacles and that pressure is effective upon the fuel and water to force them through the pipes N and M and into the generator D where a pressure of 300 pounds exists. The fuel and water are, therefore, forced into the generator chamber by the same pressure which causes the flow of air into the generator chamber. Any increase or decrease of the pressure of the air on the low pressure side of the reducing valve, resulting in an increase or decrease of the rate of flow of air into the generator chamber, effects an immediate and corresponding increase or decrease in the pressure upon the fuel and water tending to force them into the generator chamber. It results inevitably from this that the air, fuel and water are forced into the generator chamber at all times in definite proportions.

From the foregoing description of appellee's construction, it must be apparent at once that in all essential respects it is identical with the construction of the Davison patent. It is like that construction and different from the prior constructions employing the outside superheater in that water is injected into the hot products of the combustion of air and fuel for the purpose of generating steam which is supplied to the propelling engine to operate it. Instead of a superheater for heating air passing to the engine by burning fuel and a small portion of the oxygen in the air within the superheater, it employs a generator wherein the hot products of the combustion of a much larger amount of fuel and substantially all of the oxygen in the air admitted to the generator are combined with water to evaporate the water and produce steam, which steam conserves the energy in the hot products of the combustion and has a temperature which is

quite low enough to permit of introducing it safely into the engine. Furthermore, *appellee's construction is like that of the Davison patent in that the rate of feed of the fuel and water into the generator chamber is automatically regulated at all times with respect to the rate of feed of the air into the generator chamber.* Any change in the rate at which air is supplied to the generator is accompanied by an immediate and corresponding change in the rate of supply of fuel and water to the generator. The relation or proportion of these three ingredients is maintained automatically, and these proportions may be so selected as to result in the highest efficiency of operation. Thus the rate of supply of fuel may be such that all of the oxygen in the air admitted will be utilized for combustion. The air may be enriched by increasing its content of oxygen and then even more fuel may be burned, resulting in the development of even more power. Also, the proportion of the water may be such that it will be adequate for reducing the temperature of the hot products of combustion down below the danger point, substituting steam for highly heated air and conserving the total energy developed, without providing any excess which would pass into the engine as water.

Finally, appellee's construction is like that of the Davison patent and different from the best of the prior constructions in that *its range far exceeds anything the prior art had ever known.* It represents the attainment of the object which Mr. Davison had in view from the start to the finish of his work. The Navy Department has in it the weapon which it lacked in 1911 and sought to obtain from Mr. Davison. Its range is 7000 or 10,000 yards, according to size, and the best of the prior types had a range of about 4000 yards (Rec., p. 9).

Difference between Appellee's and the Patented Constructions.

The only difference worthy of comment between appellee's and the patented constructions relates to the automatic regulator shown in Fig. 3 of the Davison patent. Brief discussion of it seems desirable to avoid a possible misunderstanding.

It will be noted that appellee's torpedo has reservoirs P and O for fuel and water. These reservoirs must be filled before the torpedo is launched. As the fuel and water are consumed during a run, the spaces occupied by them are filled with air. Thus, as the fuel and water drawn from the reservoirs P and O are consumed, the weight of the torpedo decreases, tending to cause it to rise to the surface, and also, the center of gravity of the torpedo shifts, tending to decrease the stability of the torpedo in the water. Obviously, such changes of operating conditions during the run of the torpedo are objectionable. Mr. Davison, in the course of the development of his invention, conceived the idea that these objectionable characteristics could be greatly reduced or even eliminated by drawing water from the sea; instead of starting with a large supply which would be diminished steadily during the run, a small supply could be carried by the torpedo and be replenished constantly from the sea during the run. This solved the difficulty so far as the water is concerned and as to the fuel, it could be forced into the generator chamber by water instead of air, without any substantial change of weight.

Such a construction seemed to present advantages of substantial value over carrying supplies of fuel and water sufficient for the entire run and feeding the fuel and water into the generator by

the direct application of air pressure, as is done in appellee's construction.

Accordingly, this further improvement made by Mr. Davison was developed and utilized and it is illustrated and described in the patent. The water is drawn in from the sea through the pipe t^1 (p. 36) and is forced by the pump t through pipes x and k to the generator f; it is also forced by the pump through pipes x and t^2 into the fuel chamber b where it displaces the fuel by forcing it out through the pipe y to the generator f. In order to employ such a construction in conjunction with the main Davison invention, it was necessary to provide for controlling the rate at which the water and fuel are fed into the generator chamber in direct accordance with the air pressure forcing the air into that chamber. This led to the automatic regulator u shown in Fig. 3 of the patent. It operates, as has been explained, to regulate the freedom of flow of water from the pump into the regulator so that the water pressure within the regulator will always bear a definite relation to the air pressure on the low pressure side of the reducing valve, because that air pressure is applied to the upper side of the diaphragm u^1 through the pipe e^1. The effect is identically the same as if the air pressure were applied through the pipe e^1 directly to the water and fuel in the reservoirs as in appellee's construction, but the interposition of the regulator controlled by the air pressure permits of supplying water from the sea as it is consumed in the generator instead of carrying enough for the entire run in the reservoir.

This construction has other advantageous features which commended it to Mr. Davison. In appellee's construction, as fuel is consumed, the

space in the fuel tank is filled with air, and hydrocarbon vapor rising from the surface of the fuel within the tank and mingling with the air therein produces an explosive mixture. With the Davison construction wherein the fuel is forced out by water, that cannot occur and the element of danger is correspondingly reduced.

Furthermore, with the Davison construction the flow of fuel cannot continue if the flow of water becomes stopped. With appellee's construction, there is the possibility that the flow of water might be stopped by some obstruction and in that case the flow of fuel would continue with the result that highly heated air would pass into the generator at a temperature which would melt the metal.

These desirable characteristics attained by the use of the regulator were fully realized by Mr. Davison and were pointed out by him in his patent. But he realized also that these features were subsidiary to and refinements upon the general principle of making the feed of the fuel and water dependent upon the feed of the air so that the flow of all three of these ingredients would vary together, and that this principle could be utilized as appellee has utilized it by causing the air to act directly upon the fuel and water just as well as by causing the air to act indirectly upon them through the intermediacy of a pump and a regulator as is illustrated in the Davison patent. This is made clear by the language of the patent, notably that appearing at the middle of page 27 of the record and that employed in claim 13 on page 31.

This difference between appellee's and the Davison constructions is, therefore, a difference which has no bearing whatever upon the issues of this

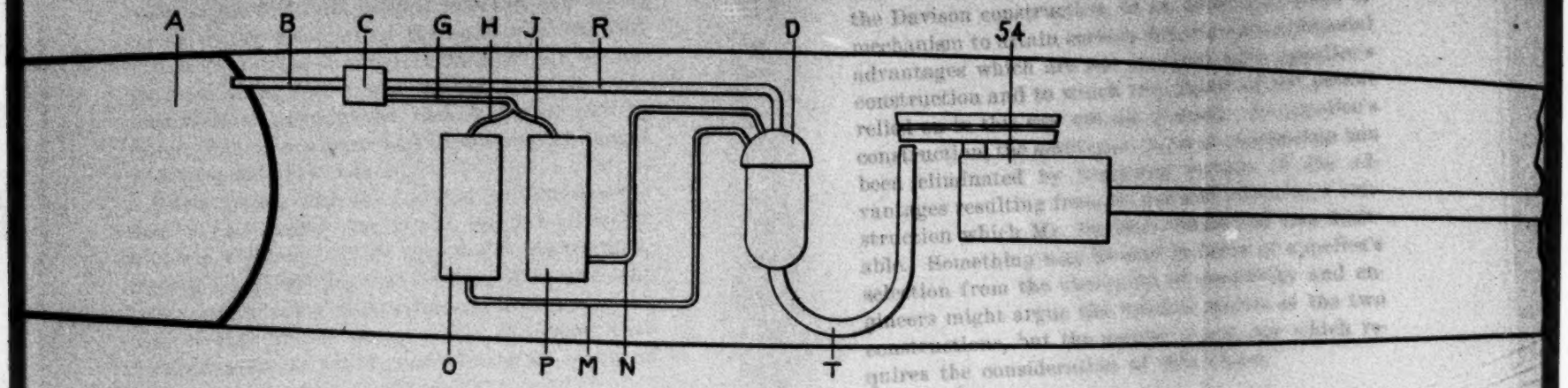
suit. It involves nothing more than the use, in the Davison construction, of an additional piece of mechanism to attain certain desired and well-known advantages which are not present in appellee's construction and to which the claims of the patent relied on in this suit are not limited. In appellee's construction, the additional piece of mechanism has been eliminated by foregoing certain of the advantages resulting from its use and adopting a construction which Mr. Davison considered less desirable. Something may be said in favor of appellee's selection from the viewpoint of simplicity and engineers might argue the relative merits of the two constructions, but the matter is not one which requires the consideration of this court.

The Claims of the Davison Patent.

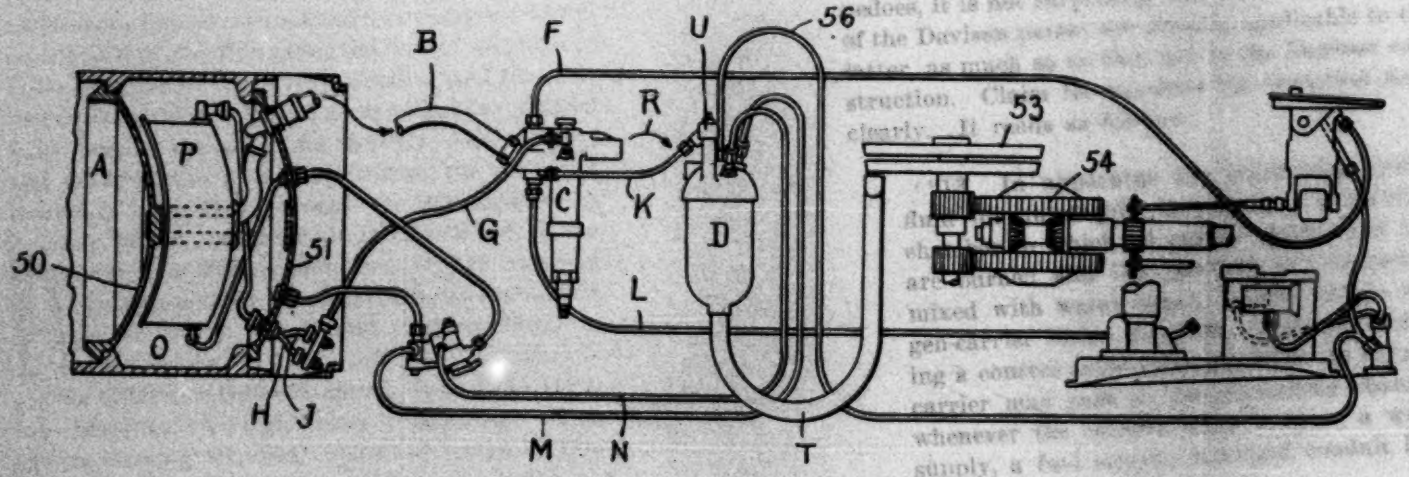
In view of the identity of structure and operation between the Davison and the appellee's torpedoes, it is not surprising that the broader claims of the Davison patent are directly applicable to the latter, as much so as they are to the Davison construction. Claim 13 recites the invention most clearly. It reads as follows:

> "13. In apparatus for supplying motive fluid for automobile torpedoes, a combustion chamber in which an explosive mixture and water are burned and the products of combustion mixed with water, a gas-generating device, a gas-carrier under pressure, a connection including a control valve through which the gas-carrier may pass to the combustion chamber whenever the control valve is open, a water supply, a fuel supply, a control valve for

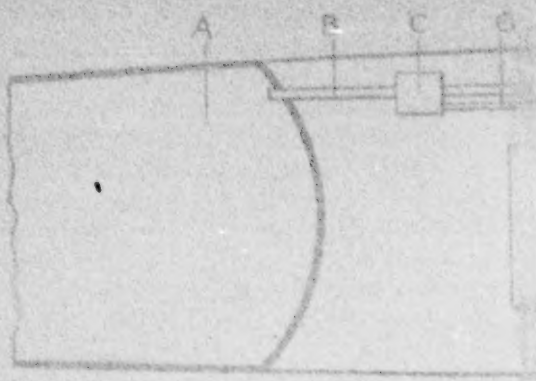
SIMPLIFIED DIAGRAM OF APPELLEE'S CONSTRUCTION.

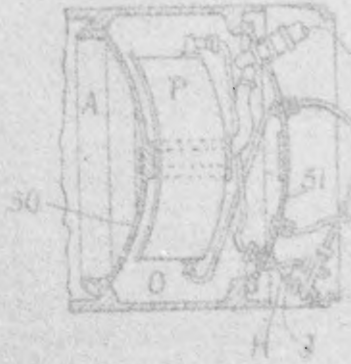


APPELLEE'S CONSTRUCTION



SIMPL





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> "13. In apparatus for generating motive fluid for automobile torpedoes, a generating chamber in which an oxygen-carrier and fuel are burned and the products of combustion mixed with water vapor, a tank for an oxygen-carrier under pressure, a conduit including a control valve through which the oxygen-carrier may pass to the generating chamber whenever the control valve is open, a water supply, a fuel supply, a second conduit like-

wise controlled by said valve and through which the pressure of the oxygen-carrier is applied to the fuel and water supply, and conduits through which the fuel and water may freely pass, under such pressure, into the generating chamber, whereby the water and fuel feed depends at all times upon the pressure of the oxygen-carrier."

Comment on this claim and the complete fulfilment of all its requirements by appellee's torpedo, seems unnecessary, in view of the foregoing description of the construction. There can be no question, and in fact it has not been denied, that appellee's construction as above described, includes an apparatus for generating motive fluid for automobile torpedoes having a generating chamber in which an oxygen-carrier and fuel are burned and the products of combustion mixed with water vapor. In connection with this wording of the claim, it may be noted that the term "oxygen-carrier" is used throughout the Davison patent, as Mr. Davison's invention contemplated either the use of atmospheric air which contains about 23 per cent. of oxygen or air enriched to contain any desired proportion of oxygen, and therefore some term other than "air," was required. Likewise, there is no ground for question, and it has not been denied, that appellee's construction includes a tank A for the oxygen-carrier under pressure, a conduit B including a control valve C through which the oxygen-carrier may pass to the generating chamber D whenever the valve C is open, a water supply O, a fuel supply P, a second conduit G likewise controlled by the valve C and

through which the pressure of the oxygen-carrier is applied to the fuel and water supply by direct contact of the air therewith, and conduits N and M through which the fuel and water may freely pass under the air pressure into the generating chamber D, whereby the water and the fuel feed depends at all times upon the pressure of the oxygen-carrier. Every word of this claim is directly applicable to the construction of appellee's torpedo; in fact, it could not be more applicable. The same wording could properly have been selected if it had been appellee's construction which was illustrated and described in the Davison patent.

Claims 1 and 5 are directed to the same subject-matter and are relied upon as infringed, but claim 13 expresses and defines the inventive idea most clearly and therefore detailed discussion of claims 1 and 5 is unnecessary. The other claims of the patent refer specifically to the refinements we have described above including the pump drawing water from the sea, the feeding of the fuel into the generator chamber by the water and the specific construction of the regulator with its rubber diaphragm and the generator chamber with its dome-shaped hood.

From the foregoing, there seems to be no opportunity for a divergence of view as to the fact that so far as concerns the elements specified in claim 13, there is no difference between Davison's and appellee's constructions. The requirements of the claim are wholly independent of any minor feature of specific structure wherein a difference between the two constructions may be found and the claim contains no words which may be construed as lim-

iting their meaning or scope to such specific structural features. If the claim be given the meaning which one would naturally give it, understanding each word employed in the claim to have its usual and commonly-accepted meaning, the conclusion is inevitable that appellee's construction comes within it.

If the meaning of the claim were obscure and difficult to understand even with the aid of the specification of the patent, there would then be a reason, in fact a necessity, for looking to other sources for assistance in arriving at the proper interpretation of the claim; and under the pressure of this necessity, the whole of the prior art might well be examined in order to ascertain the true scope of the invention which is claimed and the true meaning of the claim purporting to cover that invention. But in such a case as this, where there is nothing in the claim which is obscure and must be made clear, nothing which is vague and must be made definite, there can be no reason why the claim should not be interpreted by giving to the words employed their natural and usual meaning. And if the claim be so interpreted, there can be no argument for non-infringement, except an argument based upon a violent reading into the claim of some element which it does not on its face contain. This would not be permissible in the case of an ordinary infringement suit, and is much less so in a suit on a contract against a licensee.

There is No Occasion for Considering the Prior Art Under the Circumstances of this Case.

In view of the license, this case should be decided solely on the result of a comparison of the Davison

invention as it is described in the patent and defined, for example, in claim 13, and Appellee's torpedo as it is illustrated and described by Exhibits III and B-1 to B-4. As there is nothing ambiguous or obscure in the specification or claim, there is no occasion for examination of the prior patents forming Exhibits C-1 to C-15, and this suit should be decided without reference to them, for examination of prior art patents is not appropriate either for the purpose of establishing the invalidity of the claim relied upon or for the purpose of imposing on the claim a construction which narrows its scope beyond its plain meaning.

It is certainly clear that a licensee is estopped from denying the validity of the patent covered by his license and this is just as true when the licensee is the United States as when the licensee is an individual (*Harvey Steel Co.* vs. *U. S.*, 196 U. S., 312; 40 L. Ed., 492).

But the principle goes further than this. The licensee is estopped from reading into a plain and unambiguous claim some element not actually present there, and from relying upon the prior art in support of a contention that such a construction of the claim is necessary. If a claim could be given some strained meaning and limited scope, out of all harmony with the usual and accepted meaning of the words employed and with the description of the invention contained in the specification, then the whole effect of the rule that the claim must be assumed to be valid because of the license, would be frustrated. Therefore, "the fair meaning of the language of the claim" must determine the scope of the invention in a suit against the licensee.

There appears to be no decision of this court directly on this point, though in the *Eclipse Bicycle case* (*ante*, page 38) the bearing of the prior art on a patent covered by a license contract was urged by the defendant and does not appear to have been considered by the Court, which said that defendant's argument "gave too little effect to the contract."

The lower Courts have had frequent occasion to consider such situations. The Circuit Court of Appeals for the Seventh Circuit has announced a definite rule which is stated as follows in the leading case on the point in that Circuit:

> "In our judgment the reason of the case leads to the conclusion that, between contracting parties, extraneous evidence is inadmissible if there is no ambiguity or uncertainty in the language of the description and claims, and that, if there is uncertainty, outside evidence is admissible only to make clear what the applicant meant to claim and the government to allow, and not for the purpose of showing, even in the slightest degree, that the applicant had no right to claim and that the Government was improvident in allowing what was in fact claimed and allowed. And the conclusion accords, we think, with the weight of authority." (Cases cited.)
>
> *Siemens-Halske Electric Co.* vs. *Duncan Electric Mfg. Co.*, 142 Fed. Rep., 157,

This rule has been discussed and applied in numerous other cases in the Seventh Circuit, including the following:

Chicago & A. Ry. Co. vs. *Pressed Steel Car Co.*, 243 Fed. Rep., 883;
National Recording Safe Co. vs. *International Safe Co.*, 158 Fed. Rep., 824.

Cases in other Circuit Courts of Appeals in which the same principle has been applied without announcing a definite rule are:

United Printing Machinery Co. vs. *Cross Paper Feeder Co.*, 227 Fed. Rep., 600 (C. C. A., 1st Circuit);
Leader Plow Co. vs. *Bridgewater Plow Co.*, 237 Fed. Rep., 376 (C. C. A., 4th Circuit);
U. S. Frumentum Co. vs. *Lauhoff*, 216 Fed. Rep., 610 (C. C. A., 6th Circuit).

In some cases in Circuits other than the Seventh, this rule has not been applied so rigidly and in some instances an effort has been made to differentiate between admitting in evidence the patents of the prior art for the purpose of showing anticipation of the patent in suit and admitting them for the purpose of showing limitation of the scope of the patent. In our belief, the instances in which this has been done show clearly that the asserted distinction is one of words and not of substance; except in the exceedingly rare instance of identity of the patented invention and a proven anticipation, it is always possible to hold that the patent in suit is valid but limited to the precise structure shown in its drawing and the practical effect is the same as if the patent were held to be invalid. So admission of the prior art on the ground that its examination is justified in order to fix the scope of

the patent in suit (unless the claims of the patent are, on their face, ambiguous) is, in its practical effect, equivalent to releasing the defendant from the estoppel arising by reason of being a licensee under the patent or having assigned the patent to the plaintiff.

Refusal to examine and consider such extraneous evidence as the prior patents accompanying the Findings would be particularly appropriate in this case in view of the special facts incident to the execution of the license. At the time of its execution, appellee had just received the first torpedo of the type on which royalty is now claimed and knew from records of tests that it had attained a range of 10,000 yards as against 4,000 yards for the best ones previously available. That was what led appellee to seek the license. Its representatives knew that the Navy Department would want to purchase and use the new 10,000 yard torpedoes and that they utilized the Steam Generator developed by Davison. Thus the parties had in contemplation, at the time the license was signed, the identical type of torpedo on which appellee is now asked to pay the stipulated royalty. This involves a succession of events which will now be discussed.

History of the Contract in Suit.

The events which led up to the license agreement are set forth at length in Findings V to X and they constitute such a large proportion of the total Findings that one would expect to find in those events the basis for the Court's conclusion, facts from which the conclusion follows necessarily. The actual fact, however, is very different. Not only do the events covered by the Findings fail to support

the conclusion set forth in Finding XV, but, on the contrary, they furnish strong indication that the conclusion is erroneous.

In the fall of 1910, some two years after Davison started his work on the steam generator and after the filing of his application for the patent in suit, and after he had been urged by the Navy Department to persist in the work of developing the long-range torpedo by the use of his steam generator (Finding VI, Rec., pp. 11-12), the Navy Department entered into contracts with appellant and with E. W. Bliss Company which had long been established in the business of making for the Navy torpedoes of the inside and outside superheater types. These contracts provided for manufacture by the two companies of experimental torpedoes designed to attain greatly increased range, and to be paid for on a sliding scale of prices increasing with range and speed (Finding VIII, p. 13). Appellants' torpedo, as we have stated above, attained a range of 6,000 yards, 50% greater than the previous superheater torpedoes. The Bliss Company with its extensive facilities for making torpedoes, was able, by the use of Davison's invention, to do even better. Its torpedo attained a range of 10,000 yards at a speed of 26 knots.

It was immediately after the Bliss torpedo had run this long range that the Navy Department solicited and obtained from appellant a license under the Davison patents. It was that situation which induced the Navy officials to solicit the license. They felt the license must be had. They knew of Davison's work on the development of the steam generator and knew that the Bliss torpedo which attained the 10,000 yard range utilized the steam generator just as Davison planned to use it, and since they knew that the torpedoes then in

service were deficient because of their short range, they must have realized at once that the Navy would want to purchase the new long range torpedoes in the future. So they needed a license under Davison's patent and that was what they got under the agreement now before the Court. There was no misapprehension whatever; they all knew what the license meant and what its purpose and effect were. They knew those things the better because one of the officials consulted advised against entering into the license on the ground that it would obligate the Government to pay royalty on torpedoes like the Bliss torpedo (Finding IX, Rec., pp. 15-16). That doubtless led to more extended and more careful consideration. Then when this extended consideration led to the decision to become a licensee under the patents, there was an exchange of letters which shows the intended scope of the license (Finding X, pp. 17-18). The Navy Department called it a "shop license" and asked the appellant to insert the name of the device and the numbers of the patents under which the "shop license" was granted. In reply, appellant pointed out that the license must be understood to cover "torpedoes which the Government may build at its own works," as well as any that might be built by others. The parties being in accord as to all such matters, the agreement was drawn up by the Navy Department and sent to appellant for signature (Rec., p. 18).

These matters are so important in showing how the contract came to be made and the purpose of the parties in making it and what the parties to it understood it to mean, that they should be set forth in greater detail.

It was on September 6, 1910, shortly after the Newport Torpedo Station had discontinued its work on the steam generator and the torpedo officer

of the Navy Department had urged Davison to persist in his development work thereon, that the Navy Department entered into contracts with appellant and the Bliss Company for the manufacture of experimental long range torpedoes (Rec., p. 13). And it was toward the end of 1911 that the Bliss Company completed and tested the torpedo which it made under its contract and which attained a range of 10,000 yards (Rec., p. 14).

About the same time, on October 20, 1911, appellant wrote to the Navy Department offering to convert existing superheater torpedoes to steam generator torpedoes and offering a license under the Davison patents on a royalty basis (Rec., p. 14). This letter was transmitted to the officer in command of the Newport Torpedo Station for his comment. That officer appreciated that the proposal involved the injection of water and called attention to the fact that the Bliss Company was "proceeding along the same lines," and under date of October 27, 1911, he recorded his opposition to entering into a license agreement with appellant as follows:

> "In view of the above it is not considered wise to enter into an agreement with the Electric Boat Company by which the bureau agrees to pay the Electric Boat Company a royalty for the use of a device in torpedoes *presumably similar to devices made by other companies,* and to one which is in the course of development at the torpedo station, as by that action the bureau would, in the opinion of the torpedo station, possibly involve itself in dispute if not in litigation with the other companies, and would be estopped from further development of its own superheaters" (Rec., p. 15). (Italics ours.)

The torpedo officer of the Navy Department replied to this on November 2, 1911, by calling attention to the fact that the steam generator of the Electric Boat Company "has been patended," saying:

> "The attached correspondence is in reference to an entirely different proposition and yet connected with that proposition, inasmuch as the steam generating device will be incorporated in the Davison torpedoes, and the bureau is given to understand that this generator is not in any sense a superheater, that it *has been patented,* and it is not to conflict with the present superheater rights" (Rec., p. 16). (Italics ours.)

Again, on November 4, 1911, the officer of the Torpedo Station expressed his opposition as follows:

> "The torpedo station is still of the opinion that it would be unwise to enter into any royalty agreement with the Electric Boat Company in regard to the steam generator device of a torpedo until the details of this device are thoroughly well known and it is clearly established that the device is different from other patented devices of the same nature, and the torpedo station's previous comments were merely to recommend the nonacceptance of the Electric Boat Company's proposition as submitted, without detailed description."

Within less than a week thereafter, on November 9, 1911, the Navy Department wrote to appellant that:

> "Referring to the matter of royalties, the bureau will have drawn up an agreement by which it will agree to pay a royalty" (Rec., p. 17).

A few weeks later, on December 6, 1911, appellant wrote the Navy Department a letter whose obvious purpose was to eliminate any possible doubt as to what the proposed license agreement would cover. Appellant's letter stated:

> "It is our understanding that the royalty will apply not only to torpedoes which may hereafter be converted but also to torpedoes which the Government may build at its own works and in which the device in question is to be used" (Rec., p. 18).

The Navy Department acknowledged receipt of this letter on December 13, 1911, and stated that it was "forwarding a blank shop license or agreement." In drafting this agreement, the Department not only adopted appellant's requirement that the license cover "torpedoes which the Government may build at its own works" but went further and provided that the license should cover torpedoes made by the Department "either in its own shops or by contract in private shops."

In view of these simple facts and the plain language of the license agreement, the meaning of the agreement, what the parties intended to cover by it and what they actually did cover, are clear beyond the possibility of dispute. The thing which appellee was licensed to manufacture is explicitly defined, without ambiguity, at three places in the contract, as follows (Rec., pp. 19-20).

> *Paragraph 1.* "torpedoes equipped with Steam Generator for Automobile Torpedoes

covered by application Serial No. 422,175, dated March 9, 1908; application Serial No. 486,455, dated March 29, 1909; application Serial No. 590,627, dated Nov. 10, 1910; U. S. Patent Serial No. 980,243, dated Jan. 3, 1911, and any improvements thereon now or hereafter owned or controlled by the party of the first part * * * to the end of the term for which Letters Patent for said invention and any improvement thereon have been or may be granted."

Paragraph 2. "torpedoes equipped with the Steam Generator for Automobile Torpedoes covered by the application for Letters Patent and Letters Patent before mentioned."

Paragraph 3. "the device covered by the application for Letters Patent and Letters Patent hereinbefore mentioned, to wit, the Steam Generator for Automobile Torpedoes, or any improvements thereon now or hereafter owned or controlled by said party of the first part."

After considering the license agreement, the Court of Claims found the only thing, as it seems to us, any Court could find, namely,

> "The Government agreed to pay a substantial sum for each of the torpedoes made and accepted in accordance with the license, and containing the inventions set forth in the letters patent and the applications for letters patent enumerated in the agreement" (*post*, p. 99).

This interpretation of the contract adopted by the Court is necessary and inevitable from the lan-

guage of the contract itself; and the correspondence leading up to the contract shows that a contract of just that meaning is just what the parties to the contract intended. Furthermore, that the parties understood that the Bliss torpedo was within the license covered by the contract is plainly indicated, for it was the only torpedo then in existence which had run a long range, the contract was solicited by the Department immediately after it had run the long range, the Department's attention was called to the fact that the Davison torpedo was "presumably similar to devices made by other companies," and that the Bliss torpedo was a water injection torpedo made by "proceeding along the same lines" as Davison (Rec., p. 15), and, as soon as the license was in a form approved by both parties, the Department proceeded to order 50 torpedoes like the one which ran 10,000 yards on the test (Rec., p. 14).

Harvey Steel Co. vs. U. S.

The situation presented in this suit is strikingly similar to that which was before the Court in Harvey Steel Co. vs. U. S., 196 U. S., 310; 49 L. Ed., 492. That case was based on a license agreement relating to a patented process for hardening steel to make armor plate, known throughout the negotiations leading up to the license and designated in the license as the "Harvey process." In the suit the defendant contended that the process actually used by it was different from that described in the patent to such extent as to be outside the scope of the patent. The Court of Claims found that the process actually used by the defendant was called the Harvey process and was gen-

erally understood to be the Harvey process which had become available to the defendant by reason of Harvey's efforts; for that reason the Court refused to enter upon an examination of the Harvey patent and the prior art in the effort to fix the scope of the patent and determine whether or not the process actually used by the defendant fell within it.

On appeal, this Court affirmed the action of the Court of Claims, saying:

> "It is argued that the agreement was only to pay for the use of the process covered by the patent named, and that if the meaning of the parties was to cover anything broader than the patent, even what was known in their speech as the Harvey process, that meaning could be imported into the contract only by reformation, not by construction of the contract as it stands. But we are of opinion that this defense also must fail. * * * But the fact that the parties assumed that the process used and intended to be used was covered by the patent works both ways. It shows that they thought and meant that the agreement covered and should cover, the process actually used. We think that this can be gathered from the agreement itself, apart from the mere supposition of the parties. The contract dealt with a process 'known as the Harvey process.' It imported the speech of the parties and the common speech of the time into the description of the subject-matter."

The present case presents a close parallel. A representative of the Navy Department was informed of Davison's invention and urged him to

THE LEAVITT PATENT No. 693,872.

This patent discloses an excellent example of the second stage of the evolution of the present-day long range torpedo as set forth in Finding IV (Rec., p. 9), that is, the stage characterized by the use of torpedoes of the inside superheater type. In fact, it is our understanding that the inside superheater torpedoes used by the United States Navy were made under this Leavitt patent. This type has been described sufficiently heretofore (*ante*, pp. 16-17).

SODEAU BRITISH PATENT 15,997 AND U. S. PATENT No. 835,262.

These United States and British patents represent the third stage in the evolution of the long range torpedo, namely, that characterized by the use of the outside superheater. It is our understanding that the torpedoes of that type used by the United States Navy were made under the protection of these patents. Further comment on them would seem to be unnecessary for it was this outside superheater torpedo which was found to be deficient in practice because its range was much too short and it was because of this that Davison undertook to provide a power plant which would drive a torpedo a longer distance. These outside superheater torpedoes have also been described (*ante*, pp. 17-19).

DE FERRANTI BRITISH PATENT 9496 OF 1904.

This British patent consists of the patentee's speculations on a great succession of proposals of power plants to be employed in torpedoes, sub-

marine boats and elsewhere and makes extravagant claims as to the results which would be obtained by them, or rather, the results which the patentee hoped would be obtained. Specific directions as to the application of the ideas are conspicuously absent. Along with a great mass of other general suggestions as to how turbines may be operated by compressed air, the patent proposes that air, fuel and water be admitted to the combustion chamber of an automobile torpedo for combustion of the air and fuel and introduction of the water into the products of combustion to generate steam, *but with no suggestion of any automatic regulation of the relative proportions of these three ingredients.* De Ferranti's suggestion is quite distinct from Davison's invention and from the combinations covered by the claims relied upon in this suit in that De Ferranti illustrates and describes the fuel and water as fed into the combustion chamber by mechanically driven pumps geared to the propeller shafts. Thus, the rate of feed of water and fuel into the combustion chamber is made to depend upon the speed of the engine instead of upon the pressure of the air and therefore on the rate of feed of the air into the combustion chamber. Because of this, De Ferranti's proposal differs from Davison's invention in a respect which is emphasized as of importance in the Davison patent, a respect which is made a definite requirement of Davison's claims, and a respect in which the Davison invention and appellee's torpedo are precisely the same.

The De Ferranti patent corresponds to another Davison patent covered by the license, namely No. 1,036,082, to which we have heretofore referred (*ante*, p. 14).

Sodeau British Patent No. 6081 of 1907.

Figures 1 to 5 of this patent show constructions which bear a marked resemblance to Figure 2 of the Sodeau U. S. patent No. 835,262. The superheater is shown at *g* and air flows into it at one end through pipe *f* and out at the other end through a similar pipe. The liquid fuel is contained in a reservoir *a* which is connected to the superheater *g* and the pipe *f* by pipes *e* and *b*.

In the introductory portion of the patent, the invention is stated to relate "to heating apparatus such as used in compressed air plant for heating the air before passing the same to a motor" (Rec., p. 50). Thus the subject matter of the invention is definitely characterized as relating to a compressed air power plant in which provision is made for heating the air; in other words, the apparatus is essentially an *air heater* of the type of the superheater shown in the earlier Sodeau patents. The next lines of the patent make this even more clear by stating "In such plant it is known to increase the energy of the compressed air by burning therein a liquid fuel" (Rec., p. 50). The patent then states that the invention relates to the means employed for feeding the fuel into the superheater, that the feed is effected "in accordance with the density of the air flowing through the combustion chamber or the like and proportional to the quantity or rate of flow of such air" and that the feeding means is "dependent upon the kinetic energy of the air" flowing into the superheater (Rec., p. 51). The special provision for effecting the feed into the superheater is, therefore, the invention of this patent,

and hence, that special provision must be considered in detail.

It will be noted that in Fig. 1 of the patent drawings, there is a nozzle *c* located in the air pipe *f* and connected by pipe *b* to the bottom of the fuel chamber *a*. The air rushing through pipe *f* past the nozzle *c* which is pointed in the direction of the air flow, creates a suction at the end of the nozzle. This suction draws the liquid fuel up pipe *b* and out of nozzle *c*. The suction effect is augmented slightly by a funnel *d* which is mounted at the end of the nozzle *c*. The action is much the same as that which takes place in an atomizer for perfumes and medicaments and in the carburetor of an automobile. It is the velocity of the flow of the air which causes it. This velocity effect is what is meant by the kinetic energy of the air as distinguished from the dynamic energy represented by the pressure to which the air has been compressed.

In Fig. 2 of this Sodeau patent, the end of the pipe *h* projecting into the pipe *f* is pointed in the opposite direction, against the flow of air, and this end of the pipe *h* is open. Therefore, the air rushing through pipe *f* in the direction of the arrow impinges upon the open end of the pipe *h*. This impingement, or bombardment as it might be called, of the air particles moving at high velocity through the pipe *f* against the air particles in the open end of the pipe *h* effects a slight increase of pressure in pipe *h* and in the upper end of the fuel tank *a* to which pipe *h* is connected. The increase of pressure here referred to is an increase due wholly to the impingement, that is, due to the kinetic energy of the air, and is quite distinct from

the dynamic energy or static pressure of the air. The air flowing through pipe *f* may be at a high pressure, but that static pressure so far as concerns its effect on the fuel in the tank *a*, is offset by the pressure in the chamber *g* which is exerted back through the pipe *b* in opposition to the flow of the fuel. The kinetic energy of the air in pipe *f*, however, is exerted upon the upper surface of the liquid in tank *a* in addition to the static pressure on that surface and tends to force the liquid through pipe *b* into the chamber *a* where the fuel mixes with air and is burned.

Such a tube as that illustrated at *h* in Fig. 2 of the Sodeau patent is known as a Pitot tube, that is, a tube projecting into the path of travel of a moving fluid and having its end open so that the particles of the moving fluid may impinge upon the particles within the tube. Such Pitot tubes are sometimes used as measuring instruments for measuring the flow of fluids in pipes. Except for some small use in making delicate measurements, the Pitot tube is of little or no utility for the pressure developed by the Pitot effect is feeble in the extreme. Kent's "Mechanical Engineers Pocket Book," long recognized as an authority and widely used by engineers, describes the Pitot tube as follows:

> "The Pitot tube is used for measuring the velocity of fluids in motion. It has been used with great success in measuring the flow of natural gas. It is simply a tube so bent that a short leg extends into the current of fluid flowing from a tube, with the plane of the entering orifice opposed at right angles to the direction of the current. The pressure caused

by the impact of the current is transmitted through the tube to a pressure gauge of any kind, such as a column of water or of mercury or a Bourdon spring gauge. From the pressure thus indicated and the known density and temperature of the flowing gas is obtained the head corresponding to the pressure and from this the velocity."

Obviously, such a Pitot tube would be useful for feeding fuel into a combustion chamber only when the feed of a very small amount of fuel is all that would be desired, an amount comparable to the amount of liquid delivered by an atomizer. It is apparent, therefore, that the feeding means of this Sodeau British patent, consisting of a Pitot tube as in Fig. 2 or an aspirator tube as in Fig. 1, and depending upon the kinetic energy of the air, is adapted for use only when a minute amount of fuel is to be fed and only when the air flows into the generator chamber at a very high rate of speed and only when conditions preclude the use of a feeding means which would require any substantial drop of pressure between the inlet pipe *f* and the chamber *g*. This characteristic of the apparatus illustrated in the patent bears out the statement in its opening paragraph that the invention relates to a heating apparatus for heating compressed air which is supplied to a motor; the apparatus described in the patent belongs very distinctly in the class with the apparatus of the earlier Sodeau patents wherein the object sought is to heat compressed air in the course of its flow from a compressed air reservoir to the point of use.

In connection with Fig. 2, the patent specification recognizes (Rec., p. 51) that the feeding effect of the Pitot tube may be so feeble as to be insufficient in some cases; it states that when the Pitot tube is not "sufficient to effect satisfactorily the feeding", it may be assisted by placing a restriction in the air pipe, as shown at *j*, to create a drop in the static pressure of the air as it flows to the heating chamber and thus increase the rate of feed of the fuel. But the distinctive and characteristic feature of the invention disclosed in this patent is the feeding of the fuel by the kinetic energy of the air flowing at high speed in the pipe leading to the heating chamber, and any feeding of the fuel caused by a reduction of the static pressure of the air due to a restriction in the air pipe must be auxiliary to and in aid of this feed effected by the kinetic energy developed in a Pitot tube or an atomizer in accordance with the feature of the invention which distinguishes it from all others.

Figs. 3, 4 and 5 of the patent show obvious modifications and duplications of the arrangements shown in Figs. 1 and 2. In Figs. 3 and 5, both the Pitot tube of Fig. 2 and the atomizer of Fig. 1 are used together. In Fig. 4, the Pitot tube is used alone and a portion of the air entering it is carried to the fuel nozzle *c* to produce an atomizer effect there.

In Figs. 6 and 7, the idea of the preceding figures is further developed. In addition to feeding fuel into the combustion chamber, water is also fed into that chamber. The fuel reservoir is shown at *a* and a pipe leads into its upper end from a Pitot tube projecting into the pipe through which the compressed air flows into the combustion chamber. From the bottom of the fuel reservoir, a

pipe *b* carries the fuel to a spraying nozzle in the combustion chamber. In addition to these parts, there is a water chamber *n* the upper portion of which is connected to a Pitot tube *p* in the air pipe and the bottom of the reservoir is connected by a pipe *q* to a nozzle *r* in the combustion chamber. With reference to these parts, the patent states (Rec., p. 52):

> "In Figure 6 the form of fuel feed illustrated in Figure 3 is employed and in addition to the fuel tank there is provided a reservoir, *n*, for water, a solution of ammonia salts or the like. The tank, *n*, is connected by a pipe, *o* to a Pitot tube *p*, and by a pipe, *q*, to a nozzle, *r*, in the combustion chamber, whereby water or the like is sprayed into the products of combustion which not only has the effect of cooling these down to a workable point but also adds to the volume of working fluid passed to the engine. In torpedoes where space is somewhat limited this is a point of considerable importance.
>
> "In Figure 7 instead of leading the water or the like from the tank, *n*, directly into the combustion products it is first led through a spiral, *s*, placed conveniently in an enlarged portion, *t*, of the pipe leading from the combustion chamber to the engine. The water or the like is heated while passing through the spiral and is discharged into the combustion products as indicated at, *t*, in the form of a vapor or hot liquid."

In other words, when the combustion of the fuel fed into the combustion chamber and the air in

that chamber causes the temperature of the heated air to rise higher than the apparatus in which the heated air is used will stand without injury, then the water spray may be employed to reduce the temperature "to a workable point." In referring thus to the use of water, it is clear that Sodeau suggested it only as a possible addition to his main invention which was to superheat the air. His invention and his apparatus as he described them in the patent had no possibilities beyond use as an air warmer for supplying heated air as a motive fluid by burning a relatively small amount of fuel and diluting the hot products with the main body of the air.

All this is very different from the invention of Mr. Davison. In all the forms illustrated and described in the Sodeau patent, the apparatus is essentially an air heater, just like the prior types of inside and outside superheaters. It very distinctly is not a steam generator for utilizing compressed air, fuel and water to generate steam as a motive fluid for the propelling engine of a torpedo. There is no suggestion that anything done in accordance with the instruction of the patent will result in the development of an increased amount of energy, thereby making longer ranges for torpedoes possible. There is no suggestion that all the oxygen in the air admitted to the combustion chamber be utilized for combustion, thereby making it possible to burn more fuel and to develop more energy, and the contrary is clearly indicated by the fact that a Pitot tube or an atomizer would feed such a trifling amount of fuel. There is no suggestion that the development of unusually high temperatures in the combustion chamber by burning a large amount of

fuel; instead of being detrimental as it had always been considered, was a real advantage because it made it possible to admit more water which would be transformed into steam. Indeed, the teaching of this Sodeau British patent would seem to lead away from, instead of toward, the improvement in automobile torpedoes represented by the Davison patent. If there is any one thing that definitely characterizes the instruction of the Sodeau patent, it is that a Pitot tube or atomizer, depending for its operation on the kinetic energy of the air, is to be utilized for feeding the fuel, or the fuel and water, into the combustion chamber, and anyone familiar with Pitot tubes and atomizers would know at once that they are capable of developing only extremely low pressures; such a person would know at once that only a very l. .ate of feed of the fuel and water could be attained by using the kinetic energy of the air in any such contrivance as a Pitot tube, and for that reason he would recognize in the Sodeau patent only a novel form of air warmer such as the torpedo art had known and used for years prior to the grant of this patent.

Thus this Sodeau patent fails completely to disclose the inventive idea of the Davison patent. It does not relate to increasing the range of automobile torpedoes by increasing the power developed in a power plant suitable for such a torpedo, and it does not effect the feed of fuel and water into a generator chamber under the automatic control of the pressure of the air flowing into that chamber. Also, it does not comply with the requirements of claim 13 which specifies that the feed of the water and fuel "depends at all times upon the pressure of the oxygen carrier" for in the Sodeau arrangement, such small amounts of water and fuel as would be

fed into the heating chamber would have their feed dependent upon the kinetic energy or velocity of the air instead of its pressure.

One further point requires mention in this connection. When this suit was presented in the Court of Claims the first time, defendant contended that its torpedo did not operate in accordance with the Davison patent, but did operate in accordance with this Sodeau patent. This defense was held insufficient and in the subsequent proceedings, defendant abandoned its original contention entirely and relied on a claim of limitation of the scope of the license agreement (*ante* p. 6).

In answering defendant's original contention that the operation of its torpedo utilized the Pitot pressure of this Sodeau patent, it was impossible for plaintiff to demonstrate that absolutely no Pitot pressure was developed; the most that could be done was to demonstrate that if there were any such Pitot pressure, it was exceedingly minute in amount, and the more there was, the worse the operation of the torpedo would be. This accounts for a statement in "Exhibit III" describing the construction and operation of appellees' torpedo, namely, that the pressure upon the water and fuel to feed them into the generator chamber is "slightly increased by a Pitot pressure in the pipe G conveying compressed air to the water and fuel tanks" (Rec., p. 32). This, we submit, is wholly inconsequential; if appellee's torpedo is an embodiment of the patented invention, it is a matter of no consequence if the pressure for effecting the feed of the fuel and water by the means disclosed in the patent is augmented in some very slight amount by the Pitot pressure described in this

Sodeau patent. In appellee's torpedo, the static pressure of the air upon the water and fuel effective to feed them into the generator chamber is stated to be "40 or 50 lbs" (Rec., p. 32). If there is any Pitot pressure additional to this, contrary to our belief, it is of trifling proportions compared to that static pressure. The static pressure of 40 or 50 lbs. would suffice to throw a stream of water over a moderate size building, whereas that Pitot pressure would be such a pressure as one might feel if a current of air were directed against the end of his little finger.

ARTICLE IN "REVISTA MARITIMA BRAZILIERIA."

In January, 1908, a Brazilian Naval Officer published in a Brazilian magazine a short general article and a drawing descriptive of the construction of a torpedo devised by an Austrian named Geszteesy, about which the Brazilian officer had been able to collect some meagre information. This article in the Brazilian magazine came to the attention of the U. S. Navy experts on the construction and operation of automobile torpedoes and was sent by them to the E. W. Bliss Company which was then engaged in the manufacture of torpedoes for the United States Navy. It resulted in eliciting from the Bliss Company the opinion that there are "inherent difficulties against the operation of such a system" (Rec., p. 10). In view of this, examination of the article in connection with this suit would seem to be unprofitable.

A reproduction of the drawing of the Brazilian article appears on the sheet opposite page 65 of the record and a translation of the article appears on pages 35, 36 and 37.

Referring to the drawing, the usual compressed air reservoir is shown at A and a pipe *k* leads from the reservoir to a starting valve C and then to a reducing valve D. From this valve D, air at the reduced pressure passes through a pipe k^1, a mechanism I which is not described in the article except that it is characterized as a retarding apparatus, and a pipe k^{11}, and then into an air warming device consisting of a combustion chamber E mounted above a fuel reservoir F. Within the chamber E, most of the air passes upwardly from the inlet end of the pipe k^{11}, through an annular space *d* around a cylinder *t*. A small amount of the air passes through holes *i* in the lower contracted portion of the cylinder *t* and passes upwardly around the outlet ends of ducts *h* leading from the upper end of a pipe *a* which extends down into the liquid fuel in the reservoir F. This air, flowing past the ends of the ducts *h* in the head *g* of the fuel pipe *a*, picks up minute particles of the liquid fuel and forms a combustible mixture which is ignited by the fuse H. The heated air produced by this combustion flows up to the top of the cylinder *t* where it mixes with the larger body of air passing upwardly around the exterior of the cylinder *t*, so that the heated air is diluted and cooled by the unheated air, the whole passing out through the pipe M to the engine.

In addition to these parts, there is a water chamber G from which a pipe *m* leads to a passage *l* surrounding the combustion chamber E, and holes *n* connect this annular passage *l* with the interior of the chamber E around the cylinder *t*. The flow of the air upward through the space *d* and past the openings *n* causes the air to pick up particles of

water issuing through the holes *n*, and these fine particles of water carried along by the cold air mingle with the heated air passing up through the cylinder *t* and assist in reducing the temperature of the heated air, at the same time being vaporized to the form of steam which passes along with the air. Pipes *p* and *o* connect some portion of the retarding apparatus I with the water and fuel reservoirs G and F respectively, so that the upper surfaces of the water and fuel are subjected to air pressure.

The description of this Gesztesy mechanism contains no suggestion that with it any increase in the range of torpedoes may be obtained. Throughout the description, the apparatus is referred to as a "warmer," intended "for warming the air during the course of the torpedo" and the primary feature of the mechanism is stated to be that it

> "enables the engine of the torpedo to preserve all its bronze parts, which is not the case with the English warmer, in which, owing to its temperature, it becomes necessary to use steel in the pistons and distributing valves, so that the preservation of the motor is therefore difficult."

This is the *raison d'être* of this apparatus. With the outside superheater apparatus of the early Sodeau patents like United States patent 835,262, the heated air passing to the engine was so hot as to make it necessary to use steel parts in the engine where bronze parts would have been preferable; and even so, the temperature of the heated air was hundreds of degrees below what it would have been

if all of the oxygen in the air had been utilized for combustion. So this Gesztesy apparatus was devised on the theory that it effected a superior cooling of the hot products of combustion; apparently the production of a greater amount of energy was not contemplated. Also, although some water was introduced into the hot products of combustion and must necessarily have been vaporized, there was no thought of a complete departure from the established practice of using heated compressed air to a new practice of using a motive fluid consisting largely of steam.

Because, in devising this Gesztesy apparatus, there was no thought of developing more energy and generating steam as a motive fluid, the action which takes place within the combustion chamber is radically different from that which takes place in the steam generator of the Davison patent. Only a small portion of the air passing through the inlet pipe k^{11} flows through the holes at the lower end of the cylinder t and picks up liquid fuel from the ducts h. In other words, only a small fraction of the total air passing into the combustion chamber is utilized for combustion with the fuel and the generation of heat. The major portion of the air entering the combustion chamber flows up outside the cylinder t and is utilized for diluting the hot products of the combustion to reduce their temperature. This was a reproduction of the established practice of burning a small portion of the air with fuel and diluting the hot products of the combustion with the remainder of the air, and so long as that practice continued, no substantial increase in the total energy developed was possible.

A further point of difference between the Gesztesy construction and that of the Davison patent

concerns the mode of feeding the fuel and water into the combustion chamber *e*. These liquids are not fed into the combustion chamber by the static pressure of air; the feed is effected as it is in the Sodeau British patent 6081 of 1907, on the principle of an aspirator or atomizer. Instead of the forcible injection of streams of fuel and water into the combustion chamber, the flow of air past the openings *n* and *h* picks up minute particles of the liquid fuel and water and carries them along with the air. Because of this, the Gesztesy apparatus does not comply with the requirement of claim 13 of the Davison patent which specifies that the feed of the fuel and water shall depend "at all times upon the pressure of the oxygen-carrier" instead of upon the velocity of flow of the air past openings through which particles of the fuel and water are supposed to issue.

In all these respects, the Gesztesy apparatus as described in this Brazilian article is radically different from that of the Davison patent. It is quite beyond the limits of reason for one to assume that this article would have furnished sufficient instruction to a worker in the automobile torpedo art to enable him to produce a long range torpedo operating in accordance with the principle of the Davison patent, without the exercise of the prescience of an inventor. In this instance, however, it is unnecessary to speculate upon what would have been done by "the mythical man skilled in the art" because the record shows that this article was brought to the attention of persons skilled in the art who were in no sense mythical, and it shows also that they did not profit by it.

Evidently the Navy Department saw in the Gesztesy article only a disclosure of another type of superheater for it was referred to as a superheater

in the department's letter of April 17, 1908 (Rec., p. 10). Also we have the expert opinion of the engineers of the E. W. Bliss Co., referred to above; they examined the Gesztesy article and concluded that "there were inherent difficulties against the operation of such a system" (Rec., p. 10). Then when the Navy Department proposed some years later to take a license under the Davison inventions, attention was called to this Gesztesy article (Rec., p. 15, par. 4) and the execution of the license agreement immediately thereafter is convincing evidence that the opinion of the article formed by the Department and the Bliss Co. in the early part of 1908 still persisted in the latter part of 1911.

Thus it is quite evident that the Brazilian article failed to convey any suggestion of the Davison invention either to the officials of the Navy Department who examined it or to the engineers of the department's manufacturer of torpedoes whose attention was specially directed to it.

Other Patents.

There are four other patents but discussion of them is unnecessary.

One of them is U. S. patent to Sodeau No. 964,574 (Rec., opposite p. 53). It was not issued until July 19, 1910, over a year after the Davison patent was applied for. It was applied for before Davison's application was filed but that fact alone does not make it pertinent. This, however, is probably unimportant because this U. S. Sodeau patent corresponds almost exactly to the British patent No. 6081 of 1907 heretofore discussed.

Next, there are British and French patents to Gesztesy whose torpedo was partially described in

the Brazilian magazine article (Rec., pp. 53 to 65). These two patents show substantially the same construction as the article and the description contained in them is a little more comprehensive, but they need not be considered for they were not published until after Davison made his invention. It will be noted that Finding XIV (Rec., p. 22), does not place these patents in the art prior to the Davison patent; it merely states that all of the patents and the publication listed in the Finding show the development and state of the automobile torpedo art. We may add that in the proceedings before the Court of Claims there was practically no reference to either of these patents; the expert witness for plaintiff did not refer to them at all and the expert for defendant made only one brief reference to the British patent in connection with one detail which is not adequately described in the magazine article. We recall no mention of them in argument and the dates of drawings showing Davison's priority were established by a stipulation.

Then there is another of the Davison patents covered by the license agreement (Rec., facing p. 36). It issued on the same date as the patent in suit on an application filed at an earlier date. It is the patent referred to on page 14 hereof and it has no bearing on the patent in suit for it does not disclose the system of automatic regulation of air, fuel and water which distinguishes the invention of the patent in suit. Instead, the water and fuel are pumped into the combustion chamber by mechanically-driven pumps, as they are in the DeFerranti patents, a system of operation which experience has demonstrated to be impractical.

Summary.

The Invention.

Among the many matters discussed in the foregoing, some few facts stand out prominently. One of them is that a great improvement in the art of automobile torpedoes was made by someone. For many years the problem of range had confronted the inventors, designers and builders working in this art (Rec., p. 10) and their efforts had carried the art through certain stages of evolution and improvement (Rec., p. 9). But the best their efforts had produced was the outside superheater torpedo with a range of 4,000 yards and that was not good enough. Then came the steam generator torpedo with its range of 10,000 yards and the problem of range was relegated to the past.

So a great improvement was made, and if results obtained from it are at all reliable as an index, that improvement must have been an invention. Also if carrying the art forward by a great stride all at once, as distinguished from a multiplicity of individual small steps, is any index, then the improvement was an invention. And if the existence of many obstacles which had to be overcome before the improvement could be accomplished is any index, again that improvement was an invention, for we know that after the Newport Torpedo Station had experimented for eight months on the development of the steam generator, it had to admit that "the best method of introducing the water has yet to be ascertained," and in its further experimental work, it abandoned the effort to introduce water.

Assuredly it was a great improvement and the production of that improvement involved invention of high order.

THE INVENTOR.

Who made that invention? Davison did. He conceived the idea and developed a workable mechanism, and he disclosed the principles involved and one form in which the invention might be embodied in an application for patent filed in March, 1909; then he demonstrated the success of the invention in attaining its object by applying it to an existing torpedo which, notwithstanding the handicap of a second-hand engine, covered a range of over 6,000 yards, an increase in range of over 50% due directly to his steam generator (Finding XI, pp. 20-21).

Even the meagre record before this Court makes it very clear that the Navy Department recognized that it was Davison who was the inventor. We know that the Department, through its torpedo officer, urged Davison to proceed with his work on the long range torpedo. The one instance of this covered by the present record occurred in July, 1910. (Finding VI.) Up to that time, the Bliss Company had done nothing with water injection except to pronounce that such suggestion of it as appeared in the Gestezy article involved "inherent difficulties." Also at that time when the Department urged Davison to supply the much-desired improvement, the Naval Torpedo Station had just completed eight months of experimentation, had admitted that it had not found the solution and had concluded to discontinue work with water injection.

Then later on, in the fall of 1911, when the steam generator torpedo made by the Bliss Company ran 10,000 yards, the officials of the Navy Department lost no time in getting a license under the Davison

patents. They insisted upon having the license, even though one of their advisers was opposed to it. They insisted upon having it, knowing that the Davison patents covered the water-injection steam-generator torpedo and that the Bliss torpedo which ran 10,000 yards was a water-injection steam-generator torpedo; they knew this for they were told (what they already knew) that the construction covered by the Davison patents was "presumably similar to devices made by other companies" and that the Bliss Company had been "proceeding along the same lines as Davison" (Rec., p. 15).

Probably information of Davison's work was carried from Davison directly to the Bliss Company by the Naval Officer who urged Davison to persist in his work on the steam generator. That would explain the insistence of the Department upon getting a license under the Davison patents immediately after the Bliss torpedo doubled the range of the outside superheater torpedo and before ordering any of the new steam generator torpedoes from the Bliss Company. The torpedo made by the Bliss Company proved that it was a long range torpedo in the fall of 1911 and immediately the correspondence which led up to the license agreement began; and it was not until that correspondence had developed the matter up to the point of submitting the license in its final form for execution by the parties that the Department placed an order for steam generator torpedoes with the Bliss Company.

So it seems clear that it must have been Davison who made the great invention. Who other than Davison could have made it? Could it have been Gestezy, or Sodeau, or De Ferranti? These and various others had proposed, prior to Davison's

work, that water be admitted to the hot combustion products. Because of that, Davison cannot claim the parentage of this idea broadly, that is in whatever form it may be employed, and he did not do so in his patent. What he said in his patent was that this idea would be a most excellent one,

> "provided an apparatus can be devised which is of the requisite simplicity in construction and regulation, so that it may be used without danger and with the assurance that it will be in operative condition whenever it may be called upon to do its work."

Then he proceeded to describe an apparatus of "the requisite simplicity in construction and regulation" having the provision for automatic regulation of the feed of the air, fuel and water into the generator chamber which is an essential requisite of the Davison invention.

The prior workers in the art either were not seeking to develop higher power or else they did not realize how to adapt water injection to the production of higher power; the automatic regulation of the supply of the air, fuel and water, an essential of success, was never achieved by them. They did not get beyond or did not even reach that stage of progress which the Newport Torpedo Station had achieved along in June, 1910, when it reported that "the best method of introducing the water has yet to be ascertained" (Rec., p. 11).

The Revista article on the Gestezy torpedo offered no help whatever toward the solution of the problem. It came to the attention of the torpedo experts of the Navy and the Bliss Company early

in 1908 but the problem of how to attain long range continued to be a problem year after year thereafter. In fact, it made no impression upon the practical art for expert opinion condemned it by pronouncing that there were "inherent difficulties against the operation of such a system."

The Sodeau patent afforded no help. It offered the Pitot tube and an atomizer as instruments for effecting the feed of the fuel and water, but such fuel and water as one could feed with so feeble an instrument as a Pitot tube or an atomizer would not serve to increase range enough to notice it. It is evident that Sodeau was not dealing with the range problem when he suggested the use of the Pitot tube and therefore his patent is irrelevant to the subject under discussion. Moreover, his patent was granted to the firm which owned the patents on the outside superheater torpedo and yet that outside superheater torpedo is the one that was exploited and was recognized as the best available.

So also, the various speculations discussed in the de Ferranti patent afforded no help. De Ferranti's effort, unlike Sodeau's, was directed to increasing range, but that automatic regulation which is so essential to success was not comprehended by him, and his pumps for pumping the supplies of water and fuel into the generating chamber differentiate his proposal definitely from the Davison idea and from the requirements of claim 13 of the Davison patent and from the construction used in appellee's torpedo. His patent, like the Sodeau patent and the Revista article, were available to all workers in the art for years while the experts were seeking the solution of the range problem, but no

one found any help in them; in particular, the Newport Torpedo Station got no help from them and being unable to find the solution in the course of eight months of experimentation, it gave up the task.

So the process of eliminating others also establishes Davison as the inventor.

INFRINGEMENT.

The only other point that requires consideration is whether appellee's torpedo embodies Davison's invention and here again certain facts stand out prominently.

First, the object of Davison's work in the production of the invention covered by his patent was extending the range of torpedoes and he demonstrated that this object was attained by the employment of the invention. Appellee's torpedo is also a long range torpedo, its range being double that of the outside superheater torpedo which it succeeded.

Second, both appellee's torpedo and that of the Davison patent are distinctive in that a greatly increased amount of power is developed by the injection of water into the steam generator chamber where it is sprayed into the hot products of the combustion of air and fuel and vaporized to form steam which mingles with the gases of combustion and absorbs heat therefrom, thus supplying a motive fluid at high pressure but at a temperature which is within the limits of safety.

Third, the two torpedoes are alike with respect to automatic regulation of the flow of the air, fuel

and water into the generator chamber whereby the proper proportions of these three ingredients are maintained at all times. This is a distinguishing characteristic of the Davison invention; it is "the best method of introducing the water" which the Newport Torpedo Station sought to find through eight months of experimentation and then said it "has yet to be ascertained."

The two constructions are so much the same in this respect that there is exact correspondence between the descriptions of them as given in the Davison patent and in Exhibit III, as appears from the following:

APPELLANT'S TORPEDO DAVISON PATENT Rec., p. 27	APPELLEE'S TORPEDO EXHIBIT III Rec., p. 32
With this construction and arrangement of parts the pressure of the oxygen-carrier in the pipe *e* on the low pressure side of the reducing valve *d* controls absolutely the pressure on the fuel and the pressure on the water supply to the generating chamber, so that the oxygen-carrier, the fuel and the water are fed always at a predetermined pressure to the generating chamber.	The feed of fuel and water into the combustion and generating chamber D is effected by the pressure in the fuel and water tanks of low-pressure air conducted thereto from the low-pressure side of the reducing valve C by the pipe G and its branches H and J, the water and fuel being forced from said tanks to the chamber D through the pipes M and N respectively.

In respect of this major characteristic of the Davison invention to which claim 13 is directed, the two torpedoes are identical. Differences of minor detail involving features covered by other claims of the patent are not pertinent to the present controversy. They occur merely because Davison elected to carry a small supply of water in the torpedo and replenish it from the sea during the run, whereas in appellee's torpedo the supply of water for the whole run is placed within the torpedo before it is launched.

In appellee's torpedo, there is a difference of "40 or 50 pounds" between the pressure on the low-pressure side of the reducing valve and the pressure within the generator chamber. This pressure of 40 or 50 pounds acts directly upon the water and fuel to force them into the generator chamber. In appellant's construction, there is this same difference of static air pressure of 40 or 50 pounds and that pressure acts similarly upon the fuel and water to force them into the generator chamber. It does not act directly upon them as in appellee's torpedo, but indirectly through the flexible diaphragm of the regulator upon the water and through that diaphragm and the water upon the fuel. The two torpedoes are alike with respect to long range, with respect to the development of a large amount of power, with respect to water injection, with respect to automatic regulation of the flow of air, fuel and water into the generator, and with respect to the requirements of every word of claim 13 of the Davison patent.

Therefore, it seems clear beyond argument that the invention of the Davison patent as defined, for instance, in claim 13 is utilized in appellee's tor-

pedo, and that one point we consider to be the only matter at issue in this suit. In fact, since the Court of Claims decided against appellee's argument that its torpedo utilized the Pitot tube of the Sodeau patent and appellee abandoned that contention, it has not been maintained in behalf of appellee that its torpedo does not embody the Davison invention. Yet it is on this point, as well as one can judge from the opinion, that the Court of Claims decided finally against appellant. The Court did not state whether its conclusion was reached as a result of finding that the Davison patent is of limited scope or as a result of finding differences between the two torpedoes which it considered to be of great consequence. It merely announced in its Finding XV that appellee had not used appellant's invention.

The Opinion of the Court of Claims.

No elucidation of the process of reasoning by which this conclusion was reached is found in the brief opinion, notwithstanding the fact that the Court was reversing its former decision and setting aside an opinion (*post*, p. 99) which would have to be recognized, even by one who disagreed with it, as a creditable exposition of views reached by the Court after careful and intelligent consideration of the case.

The new opinion (Rec., p. 23) states that "the Findings of Fact have been amended in important particulars." But the respects in which the Findings, other than Finding XV, were amended, relate only to the license agreement and the correspondence and incidents which led up to it, and insofar as they have any bearing upon whether or

not appellee has used appellant's patented invention, they indicate that it *was* used.

The opinion says that, at most, the license agreement covers the use of the device "covered by Davison's patents or applications" and with that we agree. Then it proceeds to state that

> "Other patents in use and the state of the art convince us that other patentees than Davison, and the Government as well, were experimenting with torpedoes h a v i n g steam generators at and before the time of the shop license contract."

Very true, but what of it? What bearing has experimentation "before the time of the shop license contract" upon the validity or scope of the patent if that experimentation occurred after the application for the patent had been filed? As to the experimentation of the Government, not only did it occur after the application for the Davison patent was filed, but also it achieved nothing and led eventually to abandonment of water injection.

Then the opinion says that "not only were experiments being made but the Sodeau and other patents in evidence disclose a steam generator." Again, what of it? What we are concerned with here is a steam generator capable of producing greatly increased power and arranged for automatic regulation of the feed of water, fuel and air into the generator chamber so that these three ingredients will always enter the chamber in the proper proportions.

Then the opinion states:

> "The question resolves itself into whether the Government used the plaintiff's device or

> something covered by one of the claims in its patents. We are of the opinion that it did not."

"Did not what?" one might reasonably ask. There is no question as to "whether the Government used the plaintiff's device" if by that is meant the identical thing shown in the drawings of the Davison patent, for we have pointed out differences and discussed them in detail. All we have ever claimed is that what appellee used is so directly equivalent to the construction shown in the Davison patent as to be an embodiment of the invention covered by the patent and defined, for example, by claim 13.

Then the opinion says that

> "the shop license should not be so liberally construed as to prevent the Government showing the exact nature of the device it used and its difference from that covered by the plaintiff's claims."

Certainly the Government should not be prevented from showing such things whether the license be construed liberally or strictly.

Considering the opinion as a whole, the best guess we can make is that the Court of Claims held the Davison patent to be limited in scope so that it covers something less than it would be understood to cover from reading claim 13 and giving its words their commonly accepted meaning. Why it was concluded that the patent must be so limited and what it was held to be limited to are not stated. If they were, more direct reply could be made. Also, if it were stated what the patent was held to

be limited to, it would probably appear that claim 13 was construed as covering precisely the same combination of parts as is specified in some other claim or claims; for instance, if claim 13 were held to be limited to a construction in which the water was drawn from the sea and was used to force the fuel into the generator chamber, it would be the same in substance as claim 2 and Courts have frequently expressed their disapproval of so construing a patent as to hold two claims to be the same in meaning though they must have been solicited and granted on the theory that they were quite different. Furthermore, the Court of Claims once ruled that the patent must be held "to cover any structure that is within the fair meaning of the language of any of its claims" and cited authority for this conclusion (*post*, p. 103), but its final opinion seems to express a diametrically opposite view for which no authority is offered; the Court even said that if defendant's structure was "within the reasonable and fair meaning" of the claims of the patent, "then, certainly, the plaintiff should be compensated in accordance with the terms of the contract" (*post*, p. 103), but this self-evident truth must have been held later to be either untrue or inapplicable, though which is not stated.

This appellant or any other citizen of the United States who goes into a Court of the United States in good faith with a claim for relief which it believes to be just, is entitled, or has always been assumed to be entitled, in case its claim for relief be denied, to some indication of the reasons for the denial. In this instance, however, appellant is before this Court on appeal unable to state why its claim was denied beyond what appears in the two lines at the end of Finding XV, though it

knows that the claim was not denied because of any matter brought out in testimony taken subsequent to the allowance of the claim or because of any matter presented by appellee in its brief and argument submitted subsequent to that allowance.

Conclusion.

This appellant devoted years of effort and very large expense to devising an improvement for which there was a great need in the Navy of the United States and it was urged to do so by officers of the United States Navy who felt so keenly the need for the improvement. Moreover, its effort was successful and its success was demonstrated in convincing form. At the end of all of this experimental work, what appellant had, representing its long-continued effort and its considerable investment, was patent rights for inventions developed in the course of the work. These patent rights the Navy Department wanted and it got them by the very direct method of purchasing them from the owner by contracting to pay an agreed price. When appellant entered into that license agreement, it gave to the Navy Department practically all it had in the field of automobile torpedoes; with the Department the only purchaser of such torpedoes made in this country, the non-exclusive license which appellant gave is the equivalent of an assignment. So appellant gave up all it had in the torpedo field, all the assets it had acquired by the efforts of its technical staff and its considerable investment, relying upon the obligation covered by the contract to pay the agreed price. But its reliance has so far proven

to have been misplaced and it is dependent upon this Court to obtain the payment which should have been made years ago without so much as a request for it.

Respectfully submitted,

FREDERICK P. FISH,
WILLIAM H. DAVIS,
DEAN S. EDMONDS,
Counsel for Appellant.

New York, N. Y., December 20, 1923.

APPENDIX.

Opinion of United States Court of Claims.

Filed April 5, 1920.

Withdrawn November 15, 1920.

CAMPBELL, Chief Justice, delivered the opinion of the court:

The plaintiff alleges that it made an agreement with the Government, in accordance with which the United States was licensed and empowered to manufacture, on its own behalf, and to use, "automobile torpedoes equipped with steam generators containing the inventions" set forth in certain letters patent, and in certain applications for letters patent, and attaches to its petition a copy of the agreement. The Government agreed to pay a substantial sum for each of the torpedoes made and accepted in accordance with the license, and containing the inventions set forth in the letters patent and the applications for letters patent enumerated in the agreement. The fact that the action is based on this agreement removes some of the questions that would arise if the defendant were being sued for an infringement.

In the *Harvey Steel Company case*, 196 U. S., 310, it is said:

> "The court has not entered upon an examination of the patent; of the construction which should be given to it; of the state of the art, or of any of these questions which would properly be subjects of consideration, if this were an action for an infringement."

The position thus taken by the court in the Harvey Steel Company case may not be assumed, in its entirety, in the instant case, because in that case the contract dealt with a process "known as the Harvey process," but it is to be observed that the court emphasized the fact that the parties assumed that the process used, and intended to be used, was covered by the patent.

What the parties were concerned with in the contract in question will more clearly appear from the history of automobile torpedoes stated in the findings of fact. The general practice in the propulsion of automobile torpedoes for many years had been to use compressed air for the motive power, and, at the time of the Davison invention there had been an evolution through several stages as follows: First, the use of cold compressed air, from a compressed air storage chamber, through a reducing valve to the propelling engine. This was followed by the use of what was called the "inside superheater," which consisted of a burner located within the compressed air storage chamber for heating the air therein during the run of the torpedo. Then came what was called the "outside superheater," which was a combustion chamber located in the conduit for carrying the air from the storage reservoir to the engine, and arranged to have liquid fuel admitted to, and burned within, the chamber for the purpose of heating the air prior to its admission to the engine.

The automobile torpedoes in use by the United States Navy in the years 1907 and 1908 were of the type having the "inside superheater," and had a range of about 3,000 yards. In 1909 the Navy obtained torpedoes that were equipped with the

outside superheaters and attained a range of about 4,000 yards. With no greater range than the automobile torpedo had come to be regarded as a weapon of limited utility. The development in battleships, and their long-range armament, would tend to keep hostile vessels too far apart for a torpedo, with a limit of range of 3,000 or 4,000 yards, to be of any great or real efficiency. The desire, therefore, and the efforts of naval officers studying the question, were directed toward some method for producing a greater range. The efforts of Gregory C. Davison in that direction resulted in a fourth stage in the evolution of the automobile torpedo, namely, by the use of a steam generator to produce a new motive fluid for the engine which propels the torpedo. This steam generator was a chamber located on the low-pressure side of the reducing valve in the conduit for conducting the compressed air from the storage reservoir, and was arranged to have fuel and water admitted to the chamber under a reduced pressure of the air or oxygen carrier. The fuel was ignited and a large part of the oxygen burned and the water, admitted as stated, was converted into steam by the hot products of the combustion. This steam, with the gases of combustion, was made to constitute the motive fluid for the engine. Broadly speaking, the motive fluid thus became steam instead of cold or heated air, as in the former stages.

By the use of the steam generator the range of automobile torpedoes was increased to about double the range attained by the use of outside superheaters, which, as has been said, had improved the range over that attained by the inside superheater. In other words, the new method increased the range

to about 7,000 yards, while the range of the torpedoes using the superheaters had been 3,000 to 4,000 yards.

There can be no doubt that Davison was the first to make practical use of steam and the gases of combustion combined as the motive power for these torpedoes. He demonstrated their utility for that purpose. The much-desired result of a largely increased range was accomplished with the advent of his invention. This steam generator was something new. It marked a decided departure from the practice theretofore obtaining in its substitution of steam for heated air. It increased the volume of the motive fluid and provided a means of cooling it, so that its use would not destroy the efficiency of the engine it was intended to drive. Mr. Davison had assigned his rights to the plaintiff in certain letters patent, and applications therefor, relating to his invention, and it is hence recited in the agreement upon which this action is based that the plaintiff "is the owner of the invention known as steam generator for automobile torpedoes covered by" certain applications for patent. The patents had not been issued, nor could the parties to the agreement know, with exactness, what of the claims in the applications would be allowed to pass to patent. The defendant, admitting the fact of the "invention known as steam generator for automobile torpedoes," joins in the recital that it was "desirous of securing certain manufacturing rights with respect to said invention."

In these circumstances a question raised by defendant, in defense of the action, is whether the claims in the letters patent, issued upon the applications mentioned, are to be narrowly construed, as

the defendant urges they should be, or whether they are entitled to a liberal construction.

It is doubtless true that the claims in the patent, as issued under the applications therefor, must be considered in order to determine whether the defendant has made use of the invention referred to in the agreement; but in giving them consideration the court is not justified, by the facts of this case, in so narrowly construing them as to make an invention worthless, which was recognized by the parties themselves to be valuable. (See *Alvin Co.* vs. *Scharling,* 100 Fed., 87.) On the other hand, the inventor, or his assignee in this case, is entitled to such a construction as, having in view the intention of the parties to the agreement, will allow the patent to cover any structure that is within the fair meaning of the language of any of its claims. *United Printing Machinery Co.* vs. *Cross Paper Feeder Co.,* 227 Fed., 600, 602.

The action is not for an infringement, but seeks to recover royalties which defendant agreed to pay for the right to manufacture and use an invention which it was desirous of using. If the defendant's structure, designed and used to accomplish the result which Davison's invention first made possible and produced, and which defendant's officers had been striving for, was within the reasonable and fair meaning of claims in the applications as subsequently allowed, then, certainly, the plaintiff should be compensated in accordance with the terms of the contract. The defendant insists that each of the claims relied on by plaintiff is a combination claim, and that a patent for a combination does not cover a particular device unless all of the substantial features of the combination are

present or used. With this statement of the general rule we need not take issue. But the strictness of construction to be given the claims, and the substantial features of the combination, when the question of infringement is the issue, yields to the more liberal view that is to be taken of the claims when the defendant has admitted the validity and utility of the invention and has contracted for its use. *Harvey Steel Company case,* 38 C. Cls., 662.

The defendant's officers quickly recognized that Davison's invention was of great utility, and were desirous of using it. That invention comprised a steam generator to produce a motive fluid for automobile torpedoes. The inventor in his specifications declared he "had invented certain new and useful improvements in apparatus for generating motive fluid for automobile torpedoes," and pointed out that it would be "a great advantage to substitute for compressed air, commonly used as a motive fluid, a motive fluid derived by burning a suitable fuel with compressed air or oxygen, and then injecting into the highly heated products of combustion a quantity of water, whereby the water is converted into steam, adding to the volume of the fluid and reducing its temperature." "In this way," it was said, "there may be formed a motive fluid, under extremely high pressure and at moderate temperature, which is admirably adapted to the operation of the light, high-speed, powerful engines which are used on such torpedoes." The object of the invention was to provide an apparatus suitable for that purpose. The invention for which defendant contracted was the steam generator. The letters patent had not issued

and applications for them were pending. The central idea present in the specifications, and in the contract as well, is the steam generator. As was said by Judge Booth in *Societe Anonyme case,* 43 C. Cls., 25, 59: "It is the invention; without its presence the device fails; with it the device succeeds. The details of construction are of minor importance." The details of construction must have been given small consideration by the parties to the contract in this case, because, as has been said, the applications had not passed to patent when the contract was made. Can it be doubted that if the plaintiff were suing for an infringement the license agreement would furnish a complete defense?

The claims in the patent which are relied on are 1, 5 and 13. These claims, with the specifications, are supposedly addressed to those skilled in the particular art and require only such precision as is required to enable that class of persons to use the invention. (*Loom* vs. *Higgins,* 105 U. S. 580.) Unquestionably, these could not fail to recognize that the essential, the functioning element of the device, was a steam generator.

These claims are severally attacked by the defendant, and, giving to them the narrowest possible construction, it is sought, not only to make them practically meaningless, but also to make it appear that the Government device differed from that described by plaintiff. It is not to be assumed that the Government, after contracting for the use of an invention, not then patented, would seek by mere change of some unessential details to use the thing it had contracted for and escape the obligations of its contract.

The specifications and claims of the plaintiff's patents and the construction of defendant's device are shown in the exhibits to the findings. Without discussing these in detail it is sufficient to say that we are satisfied that the Government's device fulfilled all the material or essential requirements of claim 13. That the Government construction included a generating chamber for generating motive fluid for automobile torpedoes can not be, and is not, denied. In that chamber air, or an oxygen carrier, and fuel are burned, and the products of that combustion are mixed with water vapor. Thus air is supplanted by steam as a motive fluid, with the advantages of which we have spoken. That construction also includes a tank for the compressed air, spoken of in the claim as a tank for the oxygen carrier under pressure. It has the conduit through which the compressed air from the tank reaches the generating chamber when the control valve is open. It has the water and fuel supply. It has a second conduit, also controlled by the control valve, through which the air, or oxygen carrier, pressure is applied to the fuel and water. It provides for carrying the water and fuel under said pressure into the generating chamber, whereby their feed depends at all times upon the pressure of air or oxygen carrier. The generating chamber used by the Government, if not identical with, is clearly the mechanical equivalent of that described by Davison. The narrow construction of the claims contended for by defendant is not to be tolerated in an action on a contract made in the circumstances shown in this case. The action is not for an infringement, as was the fact in most of the cases cited by defendant. Having contracted

for plaintiff's device, and used it, the defendant should respond in accordance with its contract.

The amount it should pay is ascertainable from the number of torpedoes manufactured and accepted for defendant's use containing the plaintiff's device. The evidence upon this question was not taken because it was agreed that the question of liability would first be settled. The court decides that the Government is liable, and the case will be remanded for proof as to the amount of the liability. And it is so ordered.

Graham, Judge; Hay, Judge; Downey, Judge; and Booth, Judge, concur.